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General Engineering

Energy Transition Strategies

Ecology and Greenfield Precincts

Highlights

Evaluation of Dye Bio-Sorption

Impact of Flow Rate and Bed Height

Discovering Thoughts, Inventing Future

VOLUME 21 ISSUE 2 VERSION 1.0

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Local Renewable Energy Transition Strategies

By Gerald Braun

Introduction- The US renewable energy transition re-started about a decade ago, leveraging scale-up and maturation of solar and wind industries that expanded globally after California's pioneering wind and solar deployment in the late 1980s.1

Completing a global renewable transition will necessarily build on existing global, national and regional energy systems. But without engagement by the half million local jurisdictions around world, the transition will be as slow and uneven as it has been to date. Is there a renewable energy transition strategy that is adaptable to conditions around the world and is already working well where it is being applied. The strategy must be not only affordable but economically beneficial, or it will not be adopted in many cases until it is. There must also be a demonstrated way of financing its elements.

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Local Renewable Energy Transition Strategies

Gerald Braun

I. Introduction

The US renewable energy transition re-started about a decade ago, leveraging scale-up and maturation of solar and wind industries that expanded globally after California's pioneering wind and solar deployment in the late 1980s.1

Completing a global renewable transition will necessarily build on existing global, national and regional energy systems. But without engagement by the half million local jurisdictions around world, the transition will be as slow and uneven as it has been to date. Is there a renewable energy transition strategy that is adaptable to conditions around the world and is already working well where it is being applied? The strategy must be not only affordable but economically beneficial, or it will not be adopted in many cases until it is. There must also be a demonstrated way of financing its elements.

A simple calculation using US solar investment statistics provides a measure of how much investment will be required in the ten years remaining before climate change reaches a potential tipping point, beyond which it is impossible to plan based on current information. More than $2.7 trillion has been invested in building up global renewable energy capacity over the past decade[1]. In those same 10 years, renewable electricity sources more than doubled their share of the global power mix, from 5.9% in 2009 to 13.4% last year. Current market forecasts suggest that renewable power capacity could double again over the next five years. This near term doubling rate might continue, but renewable power's share in 2030 would be about 25% of global energy, not 100%. Thus, it becomes clear that fully decarbonizing all or most of the half million local economies on earth, while making them sufficiently resilient against economically crippling disruption, will require unprecedented rates of investment, to say the least.

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[1] California's initial renewable power deployment aborted in the early 90s as California regulators restructured California's electricity systems to expand natural gas generation. Since 2001, while California's population and economy expanded, new natural gas and renewable electricity generators helped reduce GHG emissions from California's in-state electricity generation by about a third, to nine percent of total state-wide emissions in 2017.

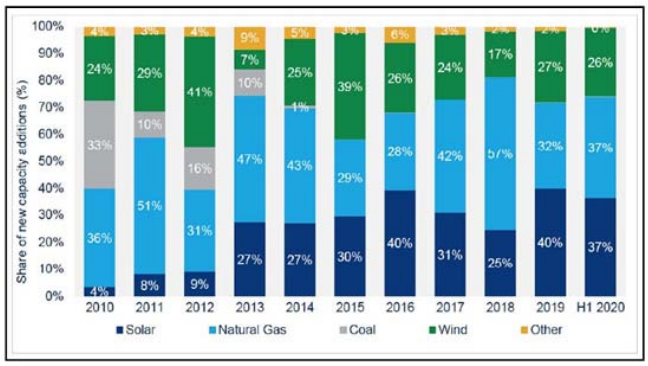

Figure 1: New U.S. Electricity Generation Capacity Additions, 2010 – H1 2020

A rough extrapolation puts the additional investment to get to 100% renewables globally at about $30 trillion. But electricity is only 40% of the global energy use. If heat and transport could be electrified, getting to a 100% renewably powered global economy would cost around $75 trillion.

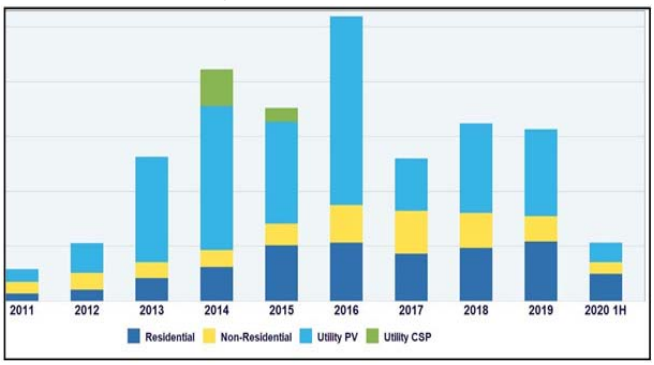

Figure 2: California Annual Solar Installations

Figure 1[ii] Shows that the transition in the U.S. so far has relied on meeting new power generation capacity needs and filling supply gaps resulting from coal fired power plant retirements with a three part portfolio of new natural gas, solar and wind generation.

Figure 2[iii] Shows the trajectory of the solar part of the portfolio in California, indicating that "utility solar", i.e., plants feeding electricity into high voltage transmission systems currently accounts for roughly 50 percent of capacity additions, while on-site deployment on residential and non-residential (mostly commercial) property accounts for the other half.

II. Renewable Energy's Role in Local Climate Action

Is there renewable transition strategy that both accelerates deployment and is generally recession-proof? There may be if local climate adaptation measures drive local renewable energy investments already having an impact. Figure 3 shows affordable local climate action options available on two major renewable deployment tracks to energy sector decarbonization and resilience, electricity and gas fuel. [iv]

Electricity		Gas Fuel
On-site solar electricity production	and	Carbon negative gas from local waste
Increased renewable electricity imports	and	Increased carbon negative gas imports
Solar/battery powered microgrids	and	Hybrid solar/gas powered microgrids
Solar powered heat pump water heaters	and	Hybrid solar/gas water heating
Solar powered heat pump space heating	and	Hybrid solar/gas space heating
Solar powered battery electric vehicles	and	Solar hydrogen fueled vehicles
Solar powered hybrid electric vehicles	and	Carbon negative gas fueled vehicles
High renewable content retail electricity	and	Micro combined heat and power

Figure 3: Recommended Local California Decarbonization and Resilience Plan Elements

In many local cases, increasing on-site solar electricity production is the most potent available measure to shrink the local carbon footprint. In parallel, locally produced bio-methane that is "carbon negative" lowers GHG emissions much more, even when burned, than if organic feedstocks were left to decompose and release methane into the atmosphere.

Microgrids increase local energy resilience, partially in the case of solar/battery powered microgrids, and fully in the case of hybrid solar/gas microgrids.

Solar energy for space and water heating can have a major impact, though in the US, it typically must be supplemented by gas fuel or backed up by grid electricity.

Personal vehicles can be fueled with solar generated hydrogen or battery-powered, preferably from a decarbonization perspective, with locally produced solar electricity.[2]

Where grid electricity from mixed sources has a high renewable content, i.e., greater than 75%, it is an acceptable substitute for locally produced solar electricity. Micro combined heat and power (micro CHP) fueled by low, zero or negative carbon gas provides full resilience and is the best option in the absence of electric service via a community or neighborhood solar/gas microgrid.

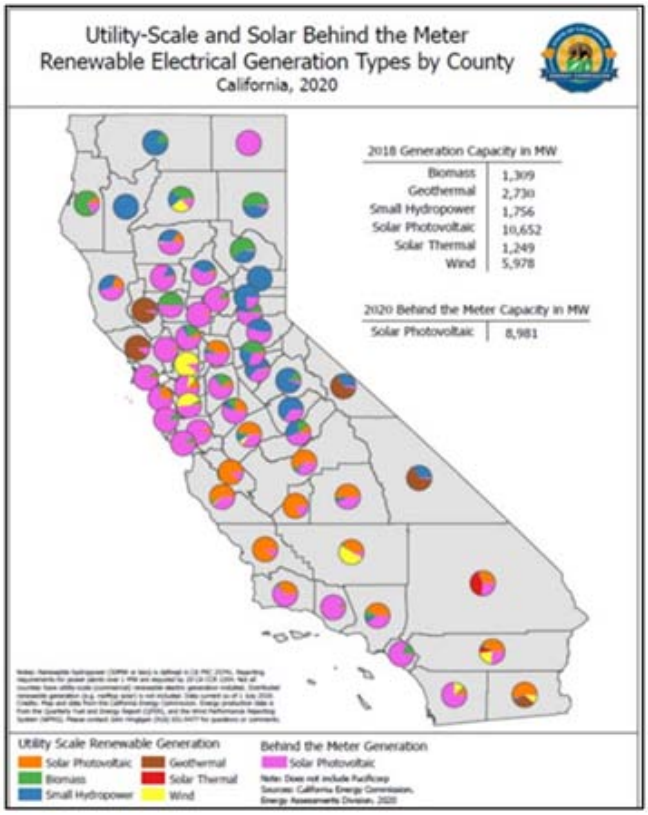

Figure 4: Sources of Renewable Electricity Capacity in California (Source: California Energy Commission)

Climate Action Planning, Implementation and Collaboration. On the electricity track there is no shortage of local planning guidance.[v] [3] On the gas fuel track, current planning guidance gaps are beginning to be filled.vi Balanced planning and implementation on each local renewable deployment track could double the combined near term impact and open new decarbonization and resilience pathways and synergies for the future. However, there is an urgent need for data-driven planning and collaboration among local governments, energy utilities, major employers and energy retailers. Collaboration opportunities are numerous, though capturing them confronts equally numerous barriers and limitations as explained in a later section.[vii]

A modest level of collaboration is already occurring in the matter of local solar electricity deployment, as electric utilities approve grid interconnections of "behind the meter" on-site solar installations, and local governments ensure compliance with local building codes. The result of even this modest

[2] Renewable hydrogen prospects are receiving a surge of government and industrial attention in Japan and Germany because of hydrogen's importance as an enabler of long term electricity storage and fuel cell electric vehicle deployment.

[3] In California local climate action planning increasingly emphasizes building sector electrification. Some local jurisdictions, e.g., most recently Oakland, have banned natural gas hook ups for new buildings. California's mild winters and the avoidance of solar customer acquisition costs in new construction make this an economically plausible renewable transition element in California's coastal areas and central valley.

level of collaboration over time in California is summarized in Figure 4viii. The figure shows that in California, about half of solar electricity deployment to date has been local, whereas in the rest of the U.S. the utility solar sector is four times as large as the combined (local) residential and non-residential sectors.

III. Pivotal Role of Local Solar Energy

a) The Solar Landscape

Figure 4 also shows every California country producing renewable energy. Some are exporters. Most are importers. Each exporting county's renewable product mix differs from all others. Most electricity generated by "utility scale" solar power plants is exported via California's state- wide power grid to other areas. Customer charges on these exports now exceed production costs by as much as a factor of two and continue to escalate.

Locally produced solar electricity is typically unavailable to renters or residents of low income neighborhoods, creating "solar deserts" akin to "food deserts". Can expansion of renewable energy production be accelerated if grid access charges for "community solar" [ix] and other community renewable projects evolve to properly account for local energy resilience benefits and actual project- specific grid usage? How much expansion of regional transmission systems can be avoided by expanding local renewable energy production?

b) Make or Buy

In the U.S., the trade-off between local and centralized solar electricity deployment has shifted dramatically in the last ten years. At the same time, top level planning implications, e.g., in California, have yet to register. Not only have solar costs plummeted across a five order of magnitude project size range, but, predictably, the cost differences between large and medium and medium and small have become less important to state and local economies than costs of transporting and storing solar electricity.

So, a fundamentally important trade-off, crucial to climate action and adaptation, is not even on state policy radar screens. There is now enough experience with both centralized renewable supply expansion and more locally beneficial on-site and community renewable energy deployment to begin putting policies in place to make informed trade-offs. The right balance must be primarily a local choice because renewable resource opportunities and energy usage differ from one community to the next. Getting to the right balance is economically and otherwise crucial to local governments and the communities they serve, but it is impossible to achieve without closer engagement with energy users, local solar retailers and energy engineers.

c) Solar Cost Shifts

More rapid and consequential shifts in solar electricity production costs have been driven by manufacturing progress curves and organizational learning in the solar project engineering and construction industry over the past decade. Impacts of scale economies and other contributing factors are quantified in Figure 5.[x]

The cost metric in the figure is installed system cost, an appropriate metric for tracking progress in reducing the cost of projects in a specific market segment, e.g., projects financed by utilities or utility solar project developers.

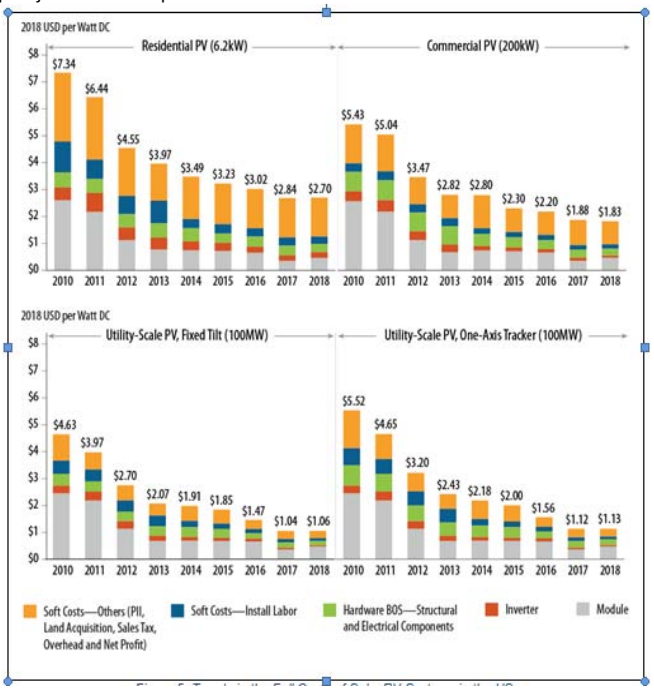

Figure 5: Trends in the Full Costs of Solar PV Systems in the US

There are significant differences in system productivity among system sizes and types, but these differences are relatively minor except for tracking vs. fixed tilt utility systems. Across a wide system size range, equipment cost fall in a narrow range , but "soft" costs, notably "customer acquisition" can be especially high in areas where residential and commercial solar are just beginning to penetrate.

Opportunistic pricing of residential and commercial systems where retail competition is still weak or non-existent results in higher soft "costs". Likewise, as installed costs continue to decline in all segments, regions where grid usage charges are set to recover costs rather than discourage deployment will see faster growth and more cost-efficient deployment.

As a metric for cost comparisons between local solar projects and utility solar projects, installed system cost is an inappropriate and misleading metric. The value of electricity produced on-site is two to three times that of electricity delivered to a site by a regional

electricity grid, and customer charges for transmission in the largest U.S. market, California, now exceed costs of solar generation at any scale.

Financing costs and methods, etc. differ markedly among the solar electricity market segments.[4] In energy utility rate-setting, customer energy transport and delivery charges are additive to the cost of importing solar electricity from distant solar resource areas. because cost recovery periods.

Comparative economics of centralized vs. local solar production will continue to shift in favor of local production as solar supply costs trend downward and as large projects come on stream and drive a need for longer duration and more costly energy storage.

d) A Good Deal Getting Better

While solar PV has become a cost-effective choice for utilities seeking to add centralized generation capacity or replace existing capacity, it is an even better choice for electricity users that gets better each year as grid electricity prices continue to escalate. Property owners now recapture their on-site solar investments in as little as 5-6 years, depending on grid electricity prices and maturity and competition in the local retail solar industry. Their investments deliver major resilience, environmental and economic benefits to cities and counties, better enabling them to invest in environmental justice initiatives and a broader array of climate adaptation measures. In this integrative context, the modest and ever-shrinking difference between unit costs of utility solar electricity generation capacity and unit costs of installed local solar electricity systems are relatively inconsequential.

e) Local Deployment Capacity

Deployment capacity is key to cost-efficient investment for all solar technologies and project scales. Radical increases in solar project deployment capacities around the world mirror shifts in industrial policies of industrial nations. Within U.S., shifts have been more gradual, and differences are explained in part by political divisions among the states and differences in retail energy prices offered by state regulated utilities. States with long standing, supportive policies had local solar deployment capacities in place to build on before Federal solar tax credits became available via an economic stimulus ten years ago. Solar deployment in states with supportive policies and relatively high electricity rates increased more rapidly than in other states. For example, California electricity rates are relatively high. Its counties and cities that have relatively mature local solar deployment capacity are seeing double digit annual on-site solar expansion.

f) The Reliability Shift

Increasing severity of natural disasters erodes the reliability of local activity that depends on energy imports. Reliability of electricity service to California communities and energy users has plummeted in recently for communities and energy users subject to "power safety shut-offs" during seasons when high winds increase wildfire risks. Few California communities are completely immune.

g) The Resilience Shift

Extended energy service disruptions devastate local economies. The obvious and urgent response is to increase local energy resilience. Energy resilience is the local capacity to restore energy service quickly and indefinitely. Increased local renewable energy production and judicious renewable fuel use can provide at least partial energy resilience, thus mitigating local energy service vulnerabilities. Once technical and institutional impediments are removed, home and business energy investments[5] can be integrated with smarter local energy "distribution" infrastructure to make local energy service fully resilient.[6]

h) The Equity Shift

Economically insecure neighborhoods need to be more, not less, energy secure than their economically secure counterparts. Fairness requires that the benefits of local renewable energy supply be available to all. For example, in places where solar energy saves money and backs up traditional energy service for local businesses and homeowners, it must do the same for renters, who, on average, may have greater need for cost savings and energy security. Working with local solar retailers and energy service providers, local governments can plan and implement strategies to bridge the solar divide. One step forward in California will be to stop adding transmission charges to renewable electricity generated locally and delivered locally without passing through the regional transmission system.

IV. Local Renewable Transitions

a) Strategic Situation

In California, on-going expansion of centralized renewable electricity supply is responsive to the state's carbon neutrality goals. It enables less reliance on large power plants that convert fossil fuels to electricity. Usage changes, demand response capacities, and energy storage investments are needed to capture decarbonization benefits of large renewable projects.

[4] Levelized cost of electricity is an especially inappropriate comparative metric between costs of small medium and large solar projects because the parameters and calculation of levelized costs apply only to utility investments.

[5] I.e., investments in on-site solar heat and electricity production, community renewable gas and electricity production and battery and fuel cell electric vehicles that exchange electricity with local electricity grids

[6] "Full resilience" means the ability to quickly restore unrestricted and uninterrupted 24/7 energy services.

Investing exclusively in large renewable power plants is an incomplete decarbonization strategy that becomes more costly as renewable penetration increases. In California, it now causes rather than mitigates local electricity service disruptions.[7] Parallel expansion of local renewable supply is key to timely, but also just, safe and economically beneficial local renewable energy transitions.

b) Strategic Responses

Three foundational elements of strategic local renewable transitions are: 1) accelerated local renewable resource development by local governments in collaboration with local electricity service providers and with Community Choice[xi] wholesale electricity procurement programs (in states where they are authorized), 2) allowing property owners to generate "net positive" solar electricity based on fair allocation related grid infrastructure and operating costs, and 3) collaboration between energy utilities and local governments to implement and expand "net negative" carbon capacities for building and transportation fuel production. The terms, net negative and net positive are defined below.

c) Accelerated Local Renewable Resource Development

Counties and cities own and permit the use of land within their jurisdictions. Sites that are environmentally and otherwise suitable for renewable energy development should be inventoried and assessed to determine their economic value for purposes of renewable project development in anticipation of renewable project developer interest. Some California jurisdictions now have experience that validates the critical need for anticipatory evaluations and decisions.

d) Net Negative Carbon Local Fuel Production

Carbon intensities of major energy sources vary widely, generically, and project by project within a generic category. Figure 6xii shows generic intensities for current and emerging transportation fuels.[8] It shows that bio-methane produced from organic waste streams has widely varying carbon intensities, some deeply negative and some modestly positive. From a climate perspective negative is good. Note that projects can have carbon intensities anywhere in the range indicated by the vertical bars. The figure shows that substituting bio-methane, aka renewable natural gas (RNG), for diesel fuel has the greatest potential decarbonization benefit in the transport sector, depending on proper project design and implementation. Other recent studies suggest that sufficient bio-methane production feedstocks are available to support highly impactful substitution of bio-methane for natural gas (geologic methane) for building space and water heating.

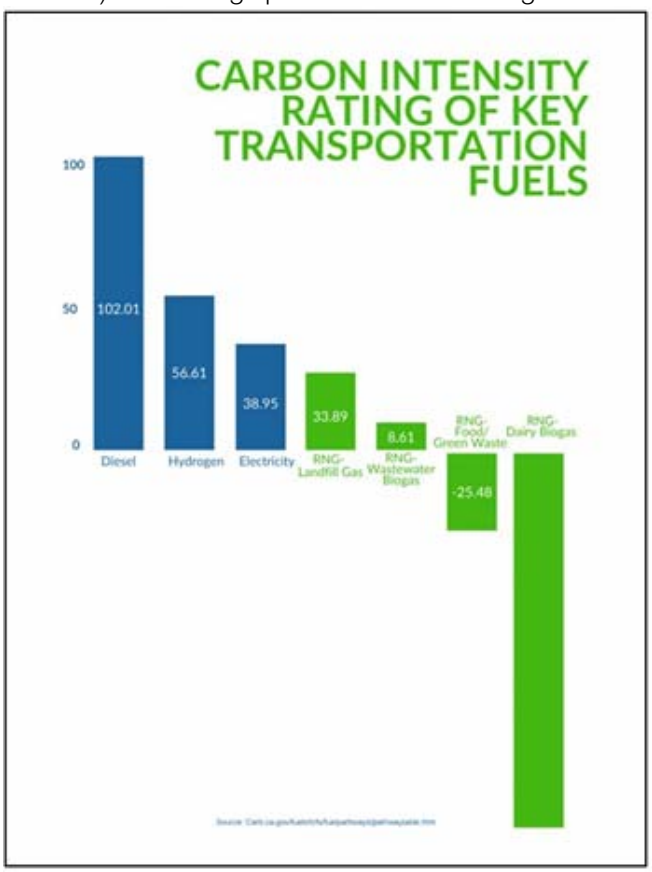

Figure 6: Synthesis of California Air Resource Board Low Carbon Fuel Standard 2020 Pathway Certified Carbon Intensities (Source: AmericanNaturalGas.com)

e) Net Positive Residential, Commercial and Public Property

In most US states, solar electricity can be produced on-site only to the extent necessary to meet historical annual usage. Thus, net zero production is possible. Net positive production exceeding historical annual usage is not allowed. This results in the need for multiple solar installations (with additive soft costs) to meet the additional electricity usage as electric vehicles and heat pump appliances are deployed to achieve net zero carbon on a site by site basis. Electricity distribution systems typically have poorer "asset utilization" than transmission systems. Behind the meter solar production tends to "unload" them during daytime

[7] Energy resilience, long a concern in disaster-prone areas, e.g. coastal areas in the southeastern US, is now a concern in California in the wake of recent, unprecedented wildfires. Technically and economically informed state- wide decarbonization and resilience planning has become a critical need, but responsibility and authority to do it at the local level remains diffuse. Regional energy utilities rely heavily on out-of-state imports and have divested, or retired, portions of the energy production fleets they once owned while the state relies on commodity energy markets it operates to attract investment in new in-state supply.

[8] An alternative fuel's carbon intensity (CI) value is divided by its Energy Economy Ratio (EER) obtain the EER- adjusted CI value, representing the emissions that occur from the use of alternative fuel per MJ of conventional fuel displaced.

hours. Investments in on-site storage may also mitigate local grid usage changes occasioned by injection of solar electricity into local distribution systems.

Net positive solar electricity production should be allowed and equitably compensated in the interest in least societal cost energy supply. Local economies will not long be well served by rules that result in under-utilization of on-site solar energy production potential. It will be increasingly vital that net electricity policies strike the best balance between meeting local grid owner concerns and local government interests in economically beneficial and equitable local climate action. For example, feed-in tariffs have been demonstrated effective in Europe and some parts of the US. As with fuel and electricity decarbonization, a combination of feed in tariffs and net metering policies will have greater decarbonization and resilience benefits than either alone.

Collaborative engagement between local governments and energy utilities will be essential to work out in each local case how best to transition from a local solar electricity deployment policy relying on net energy metering alone and one that offers multiple options to achieve more equitable access to locally produced solar electricity while maximizing benefits to local economies.

Meanwhile, should utilities and state legislators and regulators encourage investment in net positive annual on-site renewable energy production? Should net positive production be valued at the average cost of the utility's solar purchases plus related transmission costs? Environmental impacts of centralized production and high voltage transmission should weigh in the balance when judging the merits of enabling state legislation.

V. An Economically Beneficial Local Renewable Transition

Local renewable transitions can strengthen local economies in ways that cities and counties so far rarely consider, e.g., job creation and taxable assets.[9] [xiii] Economic benefits of local renewable transitions accrue primarily to energy users able to generate solar energy on property they own. In California, on-site solar investments pay back in five to ten years and result in essentially zero cost energy for decades. Their benefits also accrue to local governments and local economies in the form of dollars that recirculate locally, create local jobs and add to property values.

County Electricity Usage (MWH)	1749000
Solar Percent (%)	12
Number of Systems	11801
Combined Capacity (kW)	117134
Estimated Annual Production (MWH)	210841
Avoided Grid Electricity Generation Cost ($M/yr.)	21
Avoided Electricity Import Cost ($M/yr.)	**53**
Number of Direct, Indirect and Induced Jobs	361
Job Creation Benefit to Local Economy ($M/yr.)	**37**
Combined Jobs and Avoided Imports Benefit	**90**
Property Tax Value ($M)	463
Disaster Recovery Value ($M)	??

Figure 7: Estimated Economic Benefits of Yolo County, California On-site Solar Deployment Through 2020

Figure 7 shows the result of an analysis to roughly scope the economic impacts of on-site solar electricity production in one California country. Having Yolo County, California has a population of roughly 200,000, and a mix of urban and rural areas. Its experience illustrates how quickly local renewable transitions can progress, either on or under the radar of planners and policy makers.[10] County-wide on-site solar deployment in the past five years accounts for most of the local solar capacity that now meets twelve percent of the county's electricity usage. In some cities within the county the number of new systems has increased at an annual rate of nearly twenty percent per year.

Benefits to the county economy include well paying jobs and less money leaving the county to pay for grid electricity imports, which now total several tens of million dollars. The combined annual benefits at the end of 2020 are estimated at $90 millions. These combined benefits strengthen the county's ability to fund the implementation of climate adaptation and resilience measures and address inequities, including lack of access to cost-saving locally produced solar electricity by non-property owners.

Indirect and hard-to-quantify benefits include local electricity supply sufficient to materially enable faster recovery in the wake of disasters and mitigate loss of economic productivity in during public safety power shut-offs and blackouts costs by disasters and physical and cyber-attacks.

VI. Limitations Impeding Local Renewable Transitions

a) *Monopolistic Inertia*

Local governments and energy utilities of all stripes are monopolies. Monopolistic utility service models have held up well over many decades. But now they impede decarbonization and local energy resilience, oppose barriers to equitable local renewable energy production, and enmesh local climate action in

[9] Benefits of more local dollars recirculating locally are harder to quantify but may be even more important.

[10] A two and a half year old county-wide Community Choice program may result in improved "radar" going forward

bureaucratic inertia. Energy service in the U.S. is regulated according to state laws that are heavily influenced by energy utilities. In the California, they function as virtual money machines, collecting and spending revenues, purchasing energy they once produced, outsourcing other business functions to the extent possible and managing risks of litigation and failures of energy trading processes they do not oversee.[11] To varying degrees, they view on-site renewable energy production as a threat to erode the revenue streams on which they and their employees depend. Meanwhile, local governments struggle to implement state mandates across a wide range of services and incur significant code development and enforcement costs and risks.

b) The Local Energy Collaboration Gap

In the U.S., energy utilities and local jurisdictions typically do not pro-actively collaborate, share data or concern themselves with above-mentioned benefits of customer self-generation. In an energy resilience context, the need to do so is urgent. Lack of budget and staff capacity limits serious collaborative engagement. It may be time to authorize revenue collection on both sides to capture the societal benefits of local renewable energy transitions. For example, to fund collaborative engagement, should cities and counties be allowed to tax local solar property when and wherever it has become cost-effective on a life cycle basis? Doing so in the past would have impeded local solar deployment, but it may be time for judicious adjustments.

c) Deployment Capacity Limitations

California's ability to ramp up local solar electricity deployment in the past decade is owed to a cadre of one thousand local solar retailers and installers that grew and matured in the years prior to Federal solar tax credits, thanks to a $3B incentive program funded by the state legislature in 2006. Other states rely on utility scale renewables to decarbonize in part because local solar deployment is building on a less robust and profitable base of retailers and installers. Even in California, the retail solar industry's capacity to deploy larger non-residential systems is less evenly distributed and less mature. Cities and counties interested in capturing the local economic benefits of solar energy adoption can take steps to ensure access to competitive solar bids from locally owned solar retailers, e.g., by committing to net zero carbon conversions of public schools and local government buildings and vehicles.

[11] California's regional energy utilities rely heavily on out-of-state imports and have divested, or retired, portions of the energy production fleets they once owned, while the state relies on commodity energy markets it operates to attract investment in new in-state supply.

d) Business Model Limitations

Energy utility business models typically view wholesale energy as a commodity undifferentiated according to where it is produced. Nevertheless, state regulation typically does not preclude utilities procuring and offering locally produced renewable energy for local use. In California, Community Choice wholesale electricity suppliers are starting to do just that, acquiring experience that could lead state regulated utility counter-parts to follow suit. Utilities in other states may also lead the way.

Figure 8: Babcock Ranch Solar Micro Community North of Ft. Myers, Florida

Figure 8 shows a solar micro community in a new net-zero-carbon Florida city. The city will have a population of twenty thousand when fully built out. A utility-owned 150MW solar power plant already operating on land donated by the developer will supply electricity to residents and businesses at the same prices the utility charges customers elsewhere in its service territory. Could settled US cities collaborate with their energy utilities and/or wholesale energy providers[12] to achieve comparable results?

e) Planning Capacity Limitations

Technically and economically informed state-wide decarbonization and resilience planning has become a critical need, but responsibility and authority to do it at the local level remains diffuse. Technically and economically informed local energy transitions pay for themselves when local clean energy planning and implementation capacities are competent and mature. When planning is not founded on actual local energy system models and analysis, important trade-offs are not addressed, e.g., between

1) On-site solar vs. Community renewables,
2) Imports and local production,
3) New projects vs. Retrofits,
4) Zero carbon vs. Fully energy resilient,
5) Expedient vs. Cost-efficient actions,

[12] E.g. including mature Community Choice providers now operating in some states.

6) Formerly affordable vs. Newly affordable technologies, and
7) Readiness for action now vs. Later.

Local governments must play a stronger planning and implementation role despite funding and other limitations. Getting local trade-offs right, capturing opportunities and lowering barriers is near impossible without collaboration among local governments and energy utilities. Getting the trade-offs right requires creating local energy system models, updating them and checking progress against them.[xiv] Inputs to integrated local energy analysis and planning need to be extracted from multiple databases. So, planning and decision-making must be intensely collaborative, starting with data sharing.

VII. Summary

Where local renewable energy transitions are moving forward apace, energy user investments are now the primary driver. Local investments in on-site solar electricity and heat production can now deliver compelling life cycle cost savings in most of California, and attractive savings in many other states.

These investments have become the climate action gold standard by quickly replacing grid electricity and geologic methane with zero carbon energy and enabling local retail energy businesses to grow and prosper.

Expansion of local renewable supply is key to more timely, just, and safe state and national renewable energy transitions. US cities and counties should encourage private investment in local solar energy production because it enables faster local decarbonization and energy resilience - also because it strengthens local economies in many ways. Community renewable power and fuel production makes local energy transitions more timely – also more equitable. Local decarbonization and energy resilience progress requires technically and economically informed planning, which in turn requires greatly expanded collaboration among local governments, energy utilities and local businesses, including energy equipment contractors and retailers, fuel distributors, and major local employers.

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Ecology and Greenfield Precincts: Integrating Conservation and Bushfire Exposure Risk into Urban Planning

By Elliott Leonard Provis
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Abstract- The rapid increase in urban expansion that is currently occurring around the world creates huge expanses of contested space on the fringes of cities and towns. Urban planners are on the frontline in trying to balance the social and economic pressures of providing affordable housing and accommodating increasing human populations, with the important challenge of meeting expectations around biodiversity conservation, a healthy environment, and a safe place to live. While there are a wide range of tools and expertise available to investigate the trade-offs between potentially competing land-uses and their spatial arrangements, there are few examples of how to draw upon these existing tools and incorporate them into the planning process.

Keywords: *GeoDesign, urban development, biodiversity conservation, wildfire, modelling, planning practice, knowledge exchange.*

GJRE-J Classification: *FOR Code: 060299*

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Ecology and Greenfield Precincts: Integrating Conservation and Bushfire Exposure Risk into Urban Planning

Elliott Leonard Provis

Abstract- The rapid increase in urban expansion that is currently occurring around the world creates huge expanses of contested space on the fringes of cities and towns. Urban planners are on the frontline in trying to balance the social and economic pressures of providing affordable housing and accommodating increasing human populations, with the important challenge of meeting expectations around biodiversity conservation, a healthy environment, and a safe place to live. While there are a wide range of tools and expertise available to investigate the trade-offs between potentially competing land-uses and their spatial arrangements, there are few examples of how to draw upon these existing tools and incorporate them into the planning process. We present a case study exploring how existing scenario simulation modelling can be coupled together and used as a tool in planning practice. These models envisaged future scenarios that relate to (1) The conservation of an endangered frog species, and (2) The risk of exposure of houses to bushfire in a master planned greenfield development. We used these to explore how these existing tools can be incorporated into the strategic planning process under a Geodesign 'rules-based change model'. We uncovered our research adds to the discussion about Geodesign application in urban planning by seeking to use such a methodology, and then delving into the transition of this from theory to practice.

Keywords: GeoDesign, urban development, biodiversity conservation, wildfire, modelling, planning practice, knowledge exchange.

I. Introduction

It is widely accepted that continued urbanisation is rapidly converting many non-urban land-uses into metropolitan landscapes(Sheppard, 2019).Empirical satellite data reinforces this assertion(Burchfield et al., 2006; Shlomo et al., 2005). For any individual city, the footprint of urban expansion represents contested spaces; in some, urbanisation has been described as a clear "threat" to local ecosystems(McKinney, 2002, p. 1; as per: Oudenhoven & Groot, 2013). Modelling the impacts of urban expansion on ecosystem services has shown there are pronounced challenges in accommodating a larger human population which has been shown to compromise the ability of the surrounding environment in providing for food production, water retention, air purification, carbon storage and a safe environment(D. Zhang et al., 2017), or without causing localised species extinction. There are also growing concerns as to how cities accommodate increased populations; especially against the backdrop of climate change and technological innovation (Ghoniem, 2011; Jenks & Jones, 2008). Urban Planning informed by a strong evidence base is of critical value when navigating the transitions of these contested spaces, while protecting the ecological assets and human experiences of the altered landscapes. The challenge we now face is how to bring a strong evidence base into the planning and decision-making process.

One of the primary limitations to implementing effective land-use planning is the complex distribution of hazard and values in our landscapes (de Groot et al., 2010). A wide range of tools are available to urban planners to investigate the trade-offs between potentially competing land-uses and their spatial arrangements using modelling. Modelling has been used prior to inform discussion around ecosystem services and urban expansion (Deng et al., 2016), as well as discussion surrounding land-use and ecological functioning (J. Zhang et al., 2014); this modelling has then been an input in collaborative land-use planning workshops with stakeholders (Arciniegas & Janssen, 2012). However, there are currently no set universal definitions, guidelines or protocols for the majority of hazards and values likely to be encountered in the landscape(Aven et al., 2018; Beer & Ziolkowski, 1995). This extends to how such hazards and values might be weighed up against each-other from the perspectives of different stakeholders(Carey et al., 2006, p. 7). Unsurprisingly, there are few examples of urban planners drawing upon existing tools to investigate these competing trade-offs; the lack of literature in this area attests as such. Tools to weigh-up hazards and values from the perspectives of different stakeholders are found in abroad array of contexts within different industries and disciplines (DeFries et al., 2004). It is therefore difficult for planners to have the expertise to understand how to use all these available tools to assess values and hazards in the landscape. Incorporating these tools into planning practice without support from other practitioners or

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insights from stakeholders can present a significant challenge for incorporating evidence-based assessment processes into urban planning.

An example of potentially competing hazards and values in areas undergoing urban development are conservation of biodiversity and managing fire risk in areas with the wildland-urban interface(Bentley & Penman, 2017; Driscoll et al., 2016). In Australia, 30% of our threatened plant and animal species occur in major urban centres (Ives et al., 2016). Heard et. al describes one such endangered species which is sensitive to changes in its ecosystem, in the Growling Grass Frog, (2010).In the past, this species has been used as an indicator of biodiversity and environmental health (Hale et al., 2013; G. Heard et al., 2010; 2013). Ensuring the ecological health of urban landscapes is critical to the delivery of effective conservation outcomes. However, this country evolved with regular fire (Bradstock et al., 2012), which means that balancing conservation outcomes with the need to manage fire risk is a major challenge for many Australian cities(Moritz et al., 2014).

Evidence shows that land-use management decisions can significantly affect future risk to people and property(Buxton et al., 2011; Penman et al., 2015; Syphard et al., 2013). Past planning for disasters such as bushfire has been haphazard at best, as Oloruntoba notes “there is no evidence of continuity or holism” in Australian disaster planning (2013, p. 1677). This has been reflected in the failure of land-use planning to regulate for vulnerability to bushfire risk (Buxton et al., 2011); it was not until after the catastrophic 2009 Black Saturday Bushfires in Victoria (leading to 173 deaths) that it was seen as necessary to designate bushfire prone areas for planning and building regulation (Kuffer, 2011; Teague et al., 2009). This lack of coordination between different stakeholders could be remedied by incorporating the many tools available to planners, and differing stakeholder viewpoints into the urban planning process. One of these tools are computer generated models. Computer models can be calibrated to envision the consequences of alternate management scenarios (Syphard et al., 2007). They’re adopted into practice because of the ability of models to simplify a reality that is too difficult to predict in all of its complexity (Frysinger, 2002; as per: Syphard et al., 2007).Syphard et al. note that when models are coupled together “more complicated interactions” can be simulated, and this can “expand the scope of analysis” to incorporate differing viewpoints(2007, p. 4). Our research coupled two scenario simulation models together to gain richer insights, and deepen our breadth of knowledge. Whilst this combination of tools can further understand of complexity, knowing when to combine them into a planning process can be challenging.

Research has also emphasized the need for sciences to seek the early inclusion of planners in research projects (Fothergill, 2000; Jürgens, 2004), as this builds capacity to respond to changing climatic conditions. Some have argued that research results should be interpreted and opened up to planners because the participation of planners, and their evaluation of outputs makes it easier to provide robust and useful knowledge (Fothergill, 2000; as per: Lehtonen & Peltonen, 2006, p. 68).In-spite of the virtues of such collaboration, the fundamental problem remains that it is difficult for planners to balance all the competing interests whilst coordinating amongst so many different actors. It is therefore unsurprising that to cohesively structure a design response which considers all viewpoints and data sources, may seem largely unattainable to a local government planner. Coordinating across departmental siloes, technocrats, communities, local indigenous groups (and their requisite knowledge), private, public, and not-for-profit sectors seems the ideal approach, and yet the logistics of such coordination may seem insurmountable to a government planner.

Carl Steinitz's book 'A Framework for GeoDesign: changing geography by design' defines GeoDesign as a design process which adopts a set of concepts and methods to get stakeholders and different professions to collaboratively design together (2012). GeoDesign has been described as a method which "tightly couples" the creation of design proposals with "simulations [of outcome scenarios]" as informed by relevant geographic contexts (Flaxman, 2009). Primarily adopted during the design and planning phase, it is able to be used throughout the design process, including in the maintenance phase of design intervention construction(Nijhuis et al., 2016), and in facilitating the re-use of buildings and the development of brown field sites(Lee et al., 2014). Steinitz outlines that the basic framework for GeoDesignis premised on the dynamic collaboration of four different disciplines, 1together (2012). These are the:

1. Design Professionals
2. The Peoples of the Place
3. Geographic Sciences; and
4. Information Technologies

Our research was a multidisciplinary approach which made use of practitioners from design, the geographic sciences, and information technologies. A Doctor of Urban Ecology (Geographic Sciences), An Associate Professor of Ecosystem and Forest Sciences (Geographic Sciences/Information Technologies), a Technical Laboratory Support Officer and Masters in Ecosystems and Forest Sciences Graduate (Information

[1] Although Steinitz refers to four different collaborators which may contribute towards the GeoDesign process, these collaborators do not always represent a single individual or team. An individual or team may in fact collaborate on a project in such a way that covers two or more of the functions that Steintz describes as the four types of collaborator.

Technologies/Geographic Sciences), and a non-practicing Masters of Urban Planning Graduate (Design Professionals). All of these fields cross between design, geographic sciences, and information technologies to varying degrees; and each contributor had worked in a multidisciplinary capacity prior. Admittedly, the focus of the research as an evaluative project after the fact of approval of the Cloverton (nee Lockerbie) Precinct Structure Plan in June 2012 (Urbis, 2015, p. 10), meant that engagement of 'The Peoples of the Place' was not a possibility. Nevertheless, using data inputs from this case study, and analysis of the kind our research has produced, allowed us to test how GeoDesign could be incorporated into planning practice. It also permitted for Situation-Based Learning, as a way of further enriching the education of a Masters' graduate.

In this paper we use a rules based GeoDesign approach to investigate how two independent tools could be used in concert, to inform the planning and design of new greenfield developments on the wildland-urban interface, to ensure they simultaneously address the competing challenges of meeting conservation outcomes while reducing wildfire risk. We addressed this question using a case study approach. Case studies offer an opportunity to understand complex and dynamic systems that are bounded by location (Merriam & Tisdell, 2015), although care needs to be taken not to extrapolate findings from case studies to other situations. Conservation outcomes and bushfire risks are significantly influenced by the configuration and arrangement of features within a landscape. Adopting a case study approach ensures our research is based in reality. Therefore, we build upon a strong tradition of case study approaches to understanding wildfire risk and locational modelling of biodiversity to further advance knowledge.

This case study approach is best considered as an example of a 'rules-based change model', a distinct subset of GeoDesign model as described by Steinitz (2012). This is argued because of the similarities between the components of such a modelling approach, and because of the structure our research followed. A 'rules-based change model' is formulated as the following:

- Spatially sophisticated; behaviourally simple
- Elaborate to set up; quick to run
- Systematically and rapidly generate and test options, including sensitivity Characteristics
- Develop scenarios based on rules
- Models evaluated for potential impact
- Models used to inform debate; decision made based upon negotiated/agreed public values

Our modelling was reflective of this approach. Of the situational forms of 'rules-based change models' that manifested in our work, our model was composed of two separate models, which were coupled together. The focus of this research was to simulate different scenarios and evaluate their potential impact on both the local species biodiversity (using the Growling Grass Frog as an indicator species), and on bushfire exposure of housing in this development. The combination of tools in use sequentially was followed in our study design, and this mimicked the GeoDesign process. Due to the rules-based structure of this process (and the prescribed nature of future development), it was not able to contribute to the public decision-making process behind this development. It stands as an example of a GeoDesign process which consults various different stakeholders, although it does exclude the 'people of the place', which could be addressed in future study designs.[2]

Balancing competing risks and demands on land is a major challenge (Sharmina et al., 2016). Integrating a multidisciplinary and data driven planning process makes it possible to quantify the potential costs and benefits of alternate planning scenarios. Decisions can then be made with a quantification of the trade-offs between urban expansion, biodiversity conservation and fire risk reduction. Greater conservation outcomes, environmental sustainability and a reduction in the exposure of human-valued assets to wildfire could occur as a result.

II. Methods

a) *The case study area*

The study area for this research project is the Cloverton Development on the northern outskirts of greater Melbourne, approximately 38kms north of Melbourne's Central Business District. The site is a greenfield development and is projected to house up to 30,000 residents. It is less than 20kms from the 2009 Kilmore/Kinglake Black Saturday Bushfire, which resulted in more than 120 deaths and over 2000 houses being lost (Gibbons et al., 2012; J Leonard et al., 2009; Justin Leonard, 2009; Whittaker et al., 2013). The Cloverton development is currently surrounded by arable farmland interspersed with scattered trees and small blocks of remnant native woodlands. There is relatively flat topography in this area, with the exception of subtle depression along two creek corridors (Kalkallo and Merri Creeks) and their associated drainage lines.

These watercourses are important habitats and refuges for the Litoriarani form is(hereinafter 'Growling

[2] In the future these stakeholders could be included from the inception of the development proposal (identification of the need phase), and could be collaborative contributors with whom the professional designers, information technologies, and the geographic sciences engage with. Collaboration with such stakeholders could extend to prospective residents, as well as traditional owner groups (taking advantage of the Traditional Ecological Knowledge of these groups), allowing these peoples to influence output design (as per: Greaves, 2017, p. 24), pp. 24). This would overcome broader deficiencies of the planning process.

Grass Frog'), an endangered species in Victoria which is highly impacted by urban development in the broader Melbourne metropolitan area. Under Section 69 of the 'Conservation Forests and Land Act (1987)' this species has been identified as requiring 'Land Protection',3accorded to it by the 'Biodiversity Conservation Strategy for Melbourne's Growth Corridors' (Conservation, Forests and Land Act, 1987; State Government of Victoria, 2013). The Cloverton development is designated as a bushfire prone area by the Victorian Department of Environment, Land, Water and Planning (hereinafter 'DELWP').

The site includes provisions for a major freeway and railway along the western and northern boundaries at some time in the next 50 years. Once constructed, this freeway has the potential to influence wildfire risk and viability of the northern Merri/Kalkallo Creek populations of the Growling Grass Frog. As the Cloverton development is also identified as a Metropolitan Activity Precinct under Plan Melbourne (Department of the Environment, Land, Water and Planning, 2017) and in the Hume Corridor Integrated Growth Area Plan (City of Hume, 2015), the developers and relevant planning authority have created a Precinct Structure Plan (hereinafter 'PSP') which lays out the land-use configurations for the new development (Department of the Environment, Land, Water and Planning, 2017). These plans contain recommendations about Growling Grass Frog conservation and bushfire risk mitigation provisions and standards (City of Hume, 2012).[4]

b) Conservation challenge

Kalkallo and Merri creeks and their associated drainage lines are considered important sites for meta populations of the Growling Grass Frog. 'Guidelines for managing the endangered Growling Grass Frog in urbanising landscapes' have been developed, based on extensive research in order to inform land-use decision making where the species is known to occur(Heard et al., 2010).These guidelines are a tool developed specifically for the Victorian Department of the Environment Land Water & Planning (hereinafter 'DELWP') to understand and minimise habitat loss of an endangered species.

The guidelines recommend a minimum buffer zone of 200 m along corridors to maintain viable meta populations of Growling Grass Frog. We ran a spatially expanded meta-population model to investigate how different configurations of the riparian corridor area may impact the long-term viability of Growling Grass Frog in this landscape, as created by Heard, McCarthy, Scroggie, Baumgartner, & Parris (2013). Proposed buffers along the Kalkallo and Merri creeks range in width from 50m to 200m (City of Hume, 2012). To test how effective the proposed buffer arrangement for Growling Grass Frog meta population dynamics was, we compared between (1) the current greenfield landscape (2) the mandated PSP buffer zone width with; (3) a 50 m riparian buffer; and (4) the recommended 200 m riparian buffer (Figure 1).

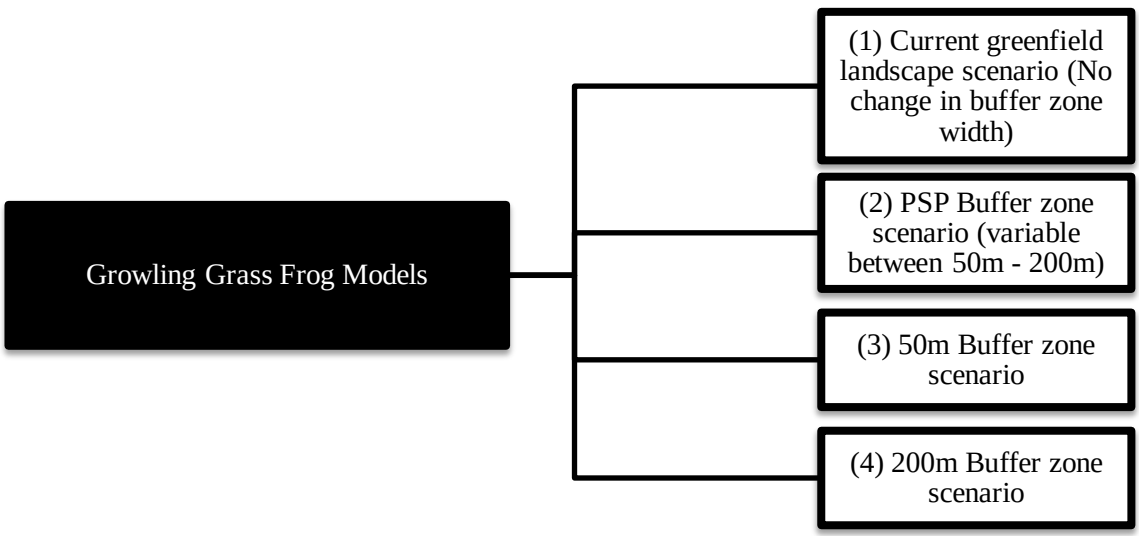

Figure 1: The Cloverton Case Study landscape and four planning scenarios

[3] There is no specific definition for this terminology as of writing.
[4] This structure plan did not include Kalkallo Township or the most northern section of the Cloverton development.

The above named model uses statistics to run multiple simulations according to a set of inputs, to then produce two outputs. Firstly it calculates the probability of a population occurring within the wet lands, that is the minimum size required that would allow for the long-term viability of the Growling Grass Frog. Following from here, the model then calculates the probability of a quasi-extinction of the Growling Grass Frog, based on the aquatic vegetation and hydroperiod of each wetland, as well as the spatial arrangement of these wetlands(Heard et al., 2013). Data from DELWP about potential sites for wetlands and pre-existing wetlands situated along the creeks was used. Where data were not available, we assigned values for aquatic vegetation coverage and the percentage of time in each year in which the wetlands would be inundated with water by comparing aerial photographs extracted from Nearmap (2017). For the proposed wetlands, an arbitrary value of 3 was assigned for vegetation coverage, & an arbitrary hydroperiod of 60 was given, as these were the default values for proposed wetlands identified by Heard et al. (2013).

c) The challenge of wildfire risk management

To calculate Fire Risk we used the fire behaviours imulator PHOENIX-RapidFire (hereinafter 'Phoenix') (Tolhurst et al., 2008),which has been developed and tested for operational use in south-eastern Australia(Bentley & Penman, 2017). This tool considered risk of exposure of housing to wildfire, because housing loss is a tangible representation of risk that is directly relevant to urban planning processes, an observation recognised in the 2009 Black Saturday Bushfire Royal Commission (Justin Leonard, 2009; Teague et al., 2009).

Phoenix uses modified versions of two common fire behaviour models to predict the spread and impact of wildfires (Penman et al., 2014).Phoenix requires inputs of weather, ignitions, fuel type and fuel load. Weather is inputted into Phoenix as hourly values of temperature, relative humidity, wind speed and direction, cloud cover and drought factor. We used three weather streams utilised for fire risk estimation by DELWP. The weather streams are defined based on the Forest Fire Danger Index(Noble et al., 1980).The Forest Fire Danger Index (hereinafter 'FFDI') is a composite index that combines the weather on the day and long-term drying of fuels present on the landscape to estimate the likelihood of fires escaping containment and becoming uncontrolled. We used values of 50 (very high), 75 (severe) and 130 (catastrophic) to cover the range of weathers that are likely to result in house loss (Blanchi et al., 2010). Ignitions were set up on a regularly spaced grid of 1 km (to simulate the randomised nature of ignitions within the environment) and each ignition was run for all combinations of weather (FFDI values of either 50, 75 or 130) and planning scenarios (current greenfield landscape, PSP mandated buffer zone, 50m buffer zone, 200m buffer zone).Information detailing the fuel types and fuel loads was based on the current data layers extracted from DELWP materials. These values were then varied according to the planning scenario being tested meaning urban fuels replaced the grassland fuels within the proposed housing zones (for the PSP mandated buffer zone, 50m buffer zone, and 200m buffer zone scenarios). There was no such variance for the current greenfield landscape scenario. The ring road was designated as a no fuel zone. Riparian shrub land (extracted from DELWPdata) was entered into Phoenix, and then altered in accordance with the different buffer zone scenarios being tested (current greenfield landscape, PSP mandated buffer zone, 50m buffer zone, and 200m buffer zone).This was done to test if the buffer zone width would impact upon the exposure of housing to bushfire. To estimate the impact on houses we calculated the average number of houses exposed per fire under each planning scenario and each FFDI. Values were then compared between scenarios using a confidence interval approach where non-overlapping 95% confidence intervals is equivocal to a $p=0.05$ significance test (Walshe et al., 2007).

d) Rules-based change model

The data inputs for both models were spatially sophisticated as the data inputs for both models were very detailed. This extended to modelling that included the location of a future potential joint road/rail corridor, exact widths of the buffer zone along the creek (current scenario, projected PSP buffer zone, a 50m buffer zone, and a 200m buffer zone). The dynamic nature of bushfire on the landscape meant that much of the modelling had to capture this complexity; similarly, the models of the behaviour of the Growling Grass Frog populations needed to account for such complexity. As the Growling Grass Frogs modelling was conducted on the local population scale (not the individual organism level), averaging was necessary.

The set-up for both models was elaborate as it required a great deal of data from different sources to be collected, and then aforesaid data to be appropriately coded. Once this set-up process had been completed, the inputs were plugged into both Phoenix and R-Studio.

The extensive outputs from both models allowed for a systematic approach to test different scenarios, and their effects on the Growling Grass Frog populations, the exposure of housing to be built in the estate, to bushfire, and the likely impact the construction of the road/rail corridor would have upon these. Once the data had been appropriately coded, and the models set up correctly, outputs were generated very rapidly.

Of the characteristics from the 'rules-based change model', our approach was premised upon scenarios which had already been set. The subdivisions

of housing have been approved by council, and the Precinct Structure Plan (which defines the strategic development of Cloverton) had also been given approval (Urbis, 2015, p. 10). The alignment of the road/rail corridor has largely been prescribed through the inclusion of a planning scheme overlay, which reserves land for this purpose (VicRoads, 2014, p. 1). As such, the simulation tools we adopted had to reflect these.

e) Sequencing a Geodesign methodology

The simulated scenarios are tools from a kit, and are used as an example to show how they could be incorporated into a process. This process is organised according to the relevant GeoDesign collaborators, and the timing of their contributions made throughout the project. These steps give a basic overview of the timing of different phases of our research. The timing of each phase is key to effectively operationalising GeoDesign approaches.

Step 1: In this step, the Design Professionals (Urban Planners) engage with other professionals via consulting, research, seeking data from administrative bodies, and other partnerships. Whilst their contributions are limited during the Generate and Evaluate phase may be limited, they guide the planning permit application, and more generally the GeoDesign process, especially when preparing information to be presented to the People of the Place. Dependent on the level of collaboration sought from the People of the Place, they could be engaged with here. This corresponds with the 'Identify the Need' and 'Identify Acceptable Scenarios based upon 'Needs', Constraints, and Knowledge/Best Practice' phase.

Step 2: Geographic Sciences identify and recruit Information Technologies and the people who utilise Information Technologies (as required/if not already working as part of the Geographic Sciences team). Information Technologists assisted in the production of raw data. This then allowed the Geographic Sciences to advise on scenarios that would balance acceptable levels of wildfire, and conservation risk, as well as permit urban expansion, and infrastructure construction. Furthermore, the practitioners of Geographic Sciences provided disciplinary knowledge, collaborative interdisciplinary skills, networked connections, as well as technical skills. The Information Technologists provided the same skill set, which was utilised in our approach. This corresponds to the 'Generate and Evaluate', and the 'Preparation of Information for the People of the Place' phase.

Step 3: Design Professionals, Geographic Sciences, or both, organise and host events for the People of the Place to provide feedback. This information is then incorporated into the plans (to varying degrees), and the completed plans are released and actioned. This mirrored the 'Presentation of Information to People of the Place' Phase (although our research was unable to extend to this point).

Each 'Step' described above, is denoted in Figure 2. Figure 2 further explores the significance of incorporating the GeoDesign process and 'how' the scenario modelling can be operationalised as a tool, to improve the coherency of urban planning.

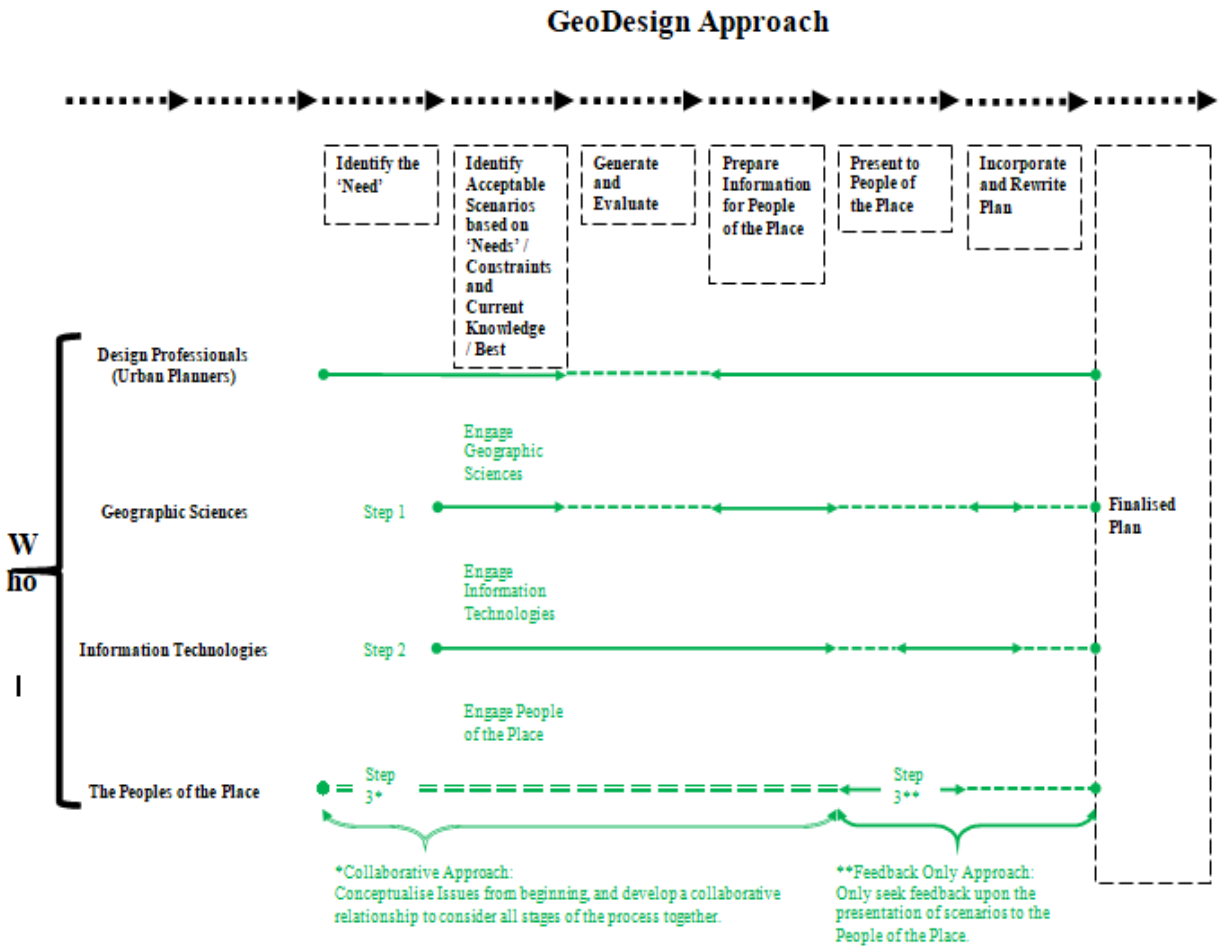

Figure 2: Sequencing of the rules-based change GeoDesign Approach as adapted from Steinitz (2012).

III. Results

a) Growling grass frog

The average percentage of wetlands predicted to be occupied by the Growling Grass Frog, was reduced in each of the scenarios associated with land-use change,compared to the control which is the current greenfield landscape scenario (as seen in Table 1). The control scenario had a 60% probability of there being enough wetlands occupied by frog populations to maintain the long-term viability of that population. This meant that all future scenarios would reduce the prevalence of Growling Grass Frog populations as compared to now. There was a 33.3% probability of enough frog populations occupying wetlands to maintain the long-term viability of the species in the PSP mandated buffer zone scenario. This probability reduced to 18.1% for the 50m buffer zone scenario. In the 200m buffer zone scenario there was a47.8%probability of longterm viability of the Growling Grass Frog, which was considerably higher than the PSP and 50m buffer zone scenarios, but lower than the current greenfield landscape scenario (which was the control scenario). The percentage of models in which the Growling Grass Frog became quasi-extinct also showed the same pattern with the 200m buffer zone scenario having quasi-extinctions in 3.2% of the models, increasing to be 6.8%of the simulations for the PSPmandated buffer zone scenarios, and in33.2%of the 50m buffer zone scenarios could a quasi-extinction be expected. It was only in 1% of models that the frogs would go quasi-extinct in the current (control) greenfield landscape scenario. Table 1 below presents these results.

Table 1: Average minimum occupancy of Wetlands and Proportion of Quasi Extinctions per model iteration.

	(1) Current greenfield landscape (control)	(2) PSP mandated buffer zone	(3) 50m buffer zone	(4) 200m buffer zone
Number of Wetlands	85	40	43	59
Average minimum percent wetlands occupied by Growling Grass Frog to maintain the long-term viability of that population.	60%	33%	18.1%	47.8%
Average percent of models in which Growling Grass Frog became quasi-extinct	1%	6.8%	33.2%	3.2%

b) Wildfire risk

The rating on the Forest Fire Danger Index has the strongest influence on the number of houses which are exposed to fire in our modelling as depicted in Figure 3; if the FFDI is a value of 50 it is considered then the combination of weather and fuels on that day then the risk of fires breaking out of containment and becoming an uncontrolled bushfire is 'very high'. At FFDI 75 this changes to a 'severe', and at FFDI 130 this becomes 'catastrophic'. According to our modelling for the 'no Outer Metropolitan Ring Road' scenarios, 198.3, 708.9, and 2572.8houses would be exposed to bushfire for FFDI's 50, 75, and 130 respectively. In the 'Outer Metropolitan Ring Road is constructed' scenarios, these values were significantly reduced to be 155.6, 503.5, and 2193.9 houses exposed in relation to FFDI's 50, 75, and 130. Width of the buffer zones had limited influence on the number of houses exposed within each Forest Fire Danger Index category. In contrast, construction of the Outer Metropolitan Ring Road resulted in a significant reduction in the number of houses exposed to bushfire within each Forest Fire Danger Index category.

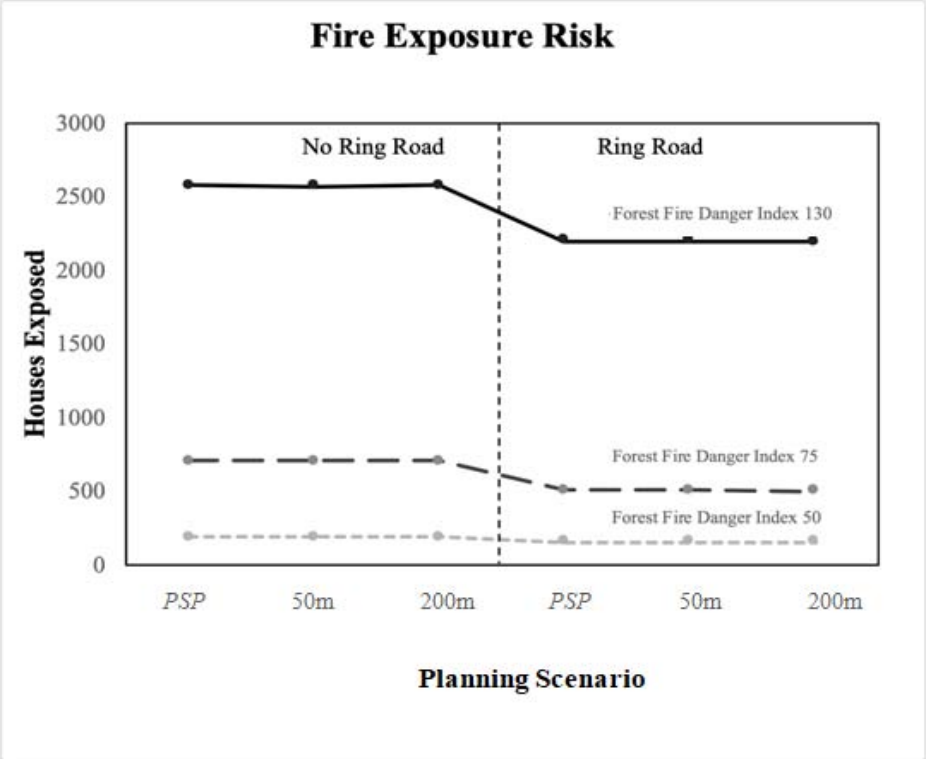

Figure 3: Fire Exposure Risk Chart depicts the different scenarios and the number of houses that were exposed to fire.

c) Comparing outputs

Models for fire and the Growling Grass Frog operated on differing spatial scales and therefore it was not possible to undertake a quantitative comparison. A qualitative assessment between the results for each scenario is presented. Fire simulations included scenarios with and without the ring road present.

Comparing conservation and fire risk outputs we found limited evidence to suggest that the wider riparian corridors would contribute to an increased risk of housing exposed to fire. The presence of the Ring Road greatly reduced the number of houses exposed to fire, although it is likely to impact on the Growling Grass Frog populations. We were unable to include the ring road as part of our simulated scenarios for the Growling Grass Frog, as the results will be dependent on finer scale aspects of the design of the ring road and associated infrastructure. In particular, the design relating to Merri Creek and associated wetlands will impact the viability of these populations. We did not attempt to include variables that would account for infrastructure design, as it would introduce too much uncertainty into our simple case study.

IV. Discussion

Our case study approach compared two potentially conflicting metrics: conservation of an endangered frog species and minimizing fire risk in new urban developments. We found that whilst changing the width of the buffers along the stream had negligible impact on the number of houses potentially exposed to fire, it did have a net positive impact on the likelihood that the threatened Growling Grass Frog would persist in the urbanising landscape. By undertaking this analysis, we were able to quantify how compromising the buffer zone width from the recommended minimum widths was likely to compromise the chances of the Growling Grass Frog persisting in the proposed plan.

Results from the two metrics were complementary, however this approach would also have been useful if they had presented conflicting results. The quantification of risk from wildfire, or the risk of Growling Grass Frog quasi-extinction would have allowed the planning process to evaluate trade-offs to deliver both outcomes in a transparent and defensible manner. Such a process requires the documentation of preferred outcomes within the bounds of what is considered to be an acceptable level of risk, and can be completed informally or using a formal process such as structured decision making (Gregory et al., 2012).

We used the case study to examine how existing scientific research can be incorporated into the planning process to help support the strategic planning process. The primary contributions our research makes to the literature is as a 'proof of concept' for a GeoDesign approach to a development approval process, which can lead to greater synergies improving

biodiversity outcomes, wildfire exposure risk reduction, balancing against continued urban growth. However, there are limitations which prevent the direct implementation of this exact approach into every day planning practice tomorrow, and our research responds to this. Some of the hurdles remaining to be cleared are knowledge barriers, institutional barriers, development project governance structures, and the fundamental politics that land-use planning entails.

It has long been acknowledged that modelling can be an effective tool for bridging the gap of understanding between local stakeholders and planning policymakers. Modelling of GIS data, has been proven to be a useful communication tool when recontextualised for consumption by local stakeholders, broadening the understanding of spatial phenomena and bridging knowledge gaps between planners and stakeholders (Rambaldi & Callosa-Tarr, 2001). Other researchers have noted that modelling tools are also an effective way of communicating planning concepts with specific restrictions (environmental, or spatial), from researchers to planners and policymakers themselves (Koomen et al., 2011, p. 118; Koomen & Borsboom-van Beurden, 2011, p. 136).

In a European example, spatial-planning researchers focussed on communicating the modelling of sea level rise to urban planners, and some of the difficulties when transforming data outputs from simulations into effective policy and processes (Lehtonen & Peltonen, 2006).5 Although on a different scale to our study, some of the issues identified by Lehtonen & Peltonen are nevertheless relevant to our discussion as they relate to knowledge barriers. They are:

1) That communication [of modelling outputs] needs to be made concrete [to planners]
2) That there is a need for "digested" scientific information [to inform urban] planning [decisions];
3) That there is a need for intermediaries and arenas to facilitate interaction between science, [modelling] and planning;
4) And finally, that clarity in planning regulation is important (2006, p. 66).

In relation to point 1, it is true that the efficacy of these tools as a way of communicating is a function of what information is available to be included in the models, in addition to the natural limitations that using a simplified model of reality impose. Although the negative impacts of a quasi-extinction of an endangered frog species may be considered unfortunate but an acceptable outcome for urban growth, the larger environmental collapse that this would necessarily indicate, is a more visceral image to draw attention to. Linking these in with potential economic or legal liabilities spawned from such degradation of the environment draws focus to these points more clearly. Contrasting this to the synergistic outputs we were able to create, and how our GeoDesign approach allowed for this is likely to focus the attention of planners and bureaucrats.

In a different European example of translating simulations across to real-world practice at the spatial-planning scale, Koomen & Borsboom-van Beurden highlight that an iterative and open character to modelling processes engaging with planners in workshops led to the success of such an approach (2011, p. 238).This is largely reflective of point 3, especially as they draw such attention to how workshops with planners and policymakers throughout the modelling phases were essential, because it allowed for multiple criteria (as defined by different bureaucratic representatives with expertise from varied backgrounds) to evolve and to be fulfilled(Koomen & Borsboom-van Beurden, 2011, p. 239). Koomen & Borsboom-van Beurden go on to note that this was key to ensuring that relevant and translatable outputs were produced. Additionally, planners and policymakers must have data outputs clearly explained to them if modelling outputs are to be used effectively. In instances in which workshops with planners throughout the modelling phase is not possible, the raw data outputs must be presented in a digestible manner.

The very nature of a Rules-Based Change GeoDesign method required the work shopping of information and collaboration over ideas to prioritise specific planning concepts, resulting in tangible potential scenarios. Our research was an iterative design process whereby we would convene to discuss changes to the inputs to the model (land-use, width of buffer zones, environmental layout), and subsequently tweak these, resulting in different model outputs that were considered to be more desirable. This is the definition of a facilitative arena, and it certainly facilitated the joint action of science and urban planning together. Coding which of the model outputs would be included in the results section allowed for them to be presented in a concise and easy to understand manner, and this allowed us to achieve both points 3 and 2.

To that end, Nilsson & Florgård argue for the transformation of raw scientific data into that format that is accessible, and yet comprehensive for all stakeholders involved in urban planning processes (2009, p. 555), in line with point 2. Argument is made from the vantage of wanting to see environmental and ecological concerns furthered in the planning process on the basis of rigorous data(Nilsson & Florgård, 2009, p. 555). Nilsson & Florgård warn that most scientific information is generally not easy for planning authorities to understand because of the differences between planning and science (2009, p. 555). They continue that

[5] This was done as as part of the 'Sea Level Change Affecting the Spatial Development in the Baltic Sea Region' project.

scientists must recognise when they're promoting segmented knowledge towards planning processes, they're just another stakeholder, competing against other stakeholders who have a deeper insight into how to influence planning process outcomes (2009, p. 555). Competition between stakeholders is what Cars (1992) terms "negotiative planning", and simply cannot be avoided in modern urban planning processes(Cars, 1992; as per: Nilsson & Florgård, 2009, p. 555).

Whilst in a GeoDesign framework these contributions are sequenced into the planning approach, the simple truth is that scientists will remain as stakeholders, not decision-makers in planning processes. Therefore, to ensure the greatest amount of success in having scientific contributions incorporated into urban planning, data outputs must be translated into a comprehensive and easily digestible format (Nilsson & Florgård, 2009, p. 555).

Furthermore, Fothergill (2000) argues that the communication between science and planning should take the form of a dialogue, instead of a scientific monologue. They argue by taking such a collaborative approach, modelling results can be conveyed more precisely, but more importantly knowledge exchange between researchers and planners can be enhanced (Lehtonen & Peltonen, 2006, p. 68). This communication would lead to the further dissemination of this information from planners in their own workplaces (Lehtonen & Peltonen, 2006, p. 68).

There are however, fundamental issues in assuming that research of this kind can be directly translated into practice, and some of these go to the problems at the heart of urban planning in Western Liberal Democratic societies. Naturally, the proceeding paragraphs relate to clarity in planning regulations, and the abovementioned point 4. For one, there is contestation over what urban planning is, and questions over what values are ascribed to 'space' and 'place' in relation to planning (Davoudi & Strange, 2009; as per: Koomen& Borsboom-van Beurden, 2011, p. 240). These issues can only be addresses in the political realm.

Research of this nature cannot be expected to account for changes in direction determined by authorities. This is especially so if it is not appropriately calibrated for such changes. This extends to expectations of research to delve into areas not considered within the original bounds of possibility.

The expectations that plans (developed in either a hypothetical scenario as described in a research paper, or as gazetted government policy) would not be altered during the implementation phase overlooks the non-determinism that characterizes reality. This doesn't even take into consideration the ever complicating role of planning at metropolitan and regional scales (de Jong & Spaans, 2009; Salet & Woltjer, 2009).

To transpose the tenets of GeoDesign presented in this research, into the Victorian planning scheme, would likely require a major overhaul of the Victorian Planning and Environment Act (1987). This is because a collective action is intrinsic to the GeoDesign approach, which stands in stark contrast to the Victorian planning scheme's development approvals process.

This process has been described as "discretionary, often contested" and "ultimately political" (Cook et al., 2012, p. 12). It would be necessary to restructure the Planning and Environment Act to ensure development approval processes were more united between sectors from the very inception of the project. This would entail greater involvement in project design and implementation through enhanced co-operation of the public, private, and not-for-profit sectors, in addition to other stakeholder groups. Design professionals, geographic sciences, information technologists, and the peoples of the place from each of the above described sectors would need to be sequentially drawn into the process. New planning approvals processes would be deployed for government planners, planning authorities, and other bureaucrats, providing a framework for their interactions. It would be necessary to educate planning practitioners, and planning authorities on these new processes and structures, through workshops and seminars.

Institutional reforms of this scale, in service of GeoDesign would likely transform governance structures for large-scale urban development projects, and this would require changes to the Planning and Environment Act. New project management regimes would be formed for big projects between multiple sectors, and this would be in addition to bureaucrats, geographic scientists, and information technologists from local, state, and federal government being engaged in projects earlier on. Naturally, the integration of planners and developers engenders a degree of scepticism of the general public.

Cook et al. note that one feature of the Victorian planning scheme is the extensive Third Party Objection and Appeal Rights (hereinafter 'TPOAR'), in which anyone can object to and appeal the approval of development projects (2012, p. 12). One advantage of this is greater "public scrutiny . . . of government decisions" in turn bringing "transparency and accountability" to the exchanges between developers and the planning approval authority(2012, p. 12). In a report on Planning, Zoning and Development Assessments, the Productivity Commission observed that strong TPOAR counters opportunities for corruption, or the general publics' perception of corruption (Productivity Commission, 2011). This is important, as the general public is suspicious of closeness between public, private, and not-for-profit sectors (an expected consequence in the application of GeoDesign). Strengthening of TPOAR may be necessary to allay this mistrust.

This research was conducted in the fulfilment of the requirements of a minor Masters thesis. This bounding ensured the project was an operation of Scenario-Based Learning. Scenario-Based Learning is based upon the use of contextual knowledge, which can bring students closer to the realities of their profession by allowing experiences which are designed to supplement rather than replace work experience (Eland et al., 2010; Errington, 2009, 2011; Mio et al., 2019; Smith et al., 2018). It fills a gap created by the growing uptake of professional work by young adults, by providing safe, reproducible, and authentic work experience (Eland et al., 2010). Although the hurdles experienced in this research may not equate to 'real world' complexities as experienced by practicing urban planners, they nevertheless represented a valuable and authentic method of learning 'through work' experience. Indeed, the very bounding of this research proved an issue as it limited the scope and therefore the detail we could provide when enquiring about the application of GeoDesign processes. Other issues we encountered in our research extended to being able to collect information from the relevant administrative bodies, appropriately weighting different values in the landscape, knowing which data-sets produced were relevant to the results, and understanding how to evaluate simulated scenarios against each other. These issues were unique to our research.

The tools in this study used different spatial scales to quantify the risk to the Growling Grass Frog and the risk of houses exposed to fire. Evidence for each risk was modelled using an appropriate scale for that value, although it reduced the opportunities to compare the two models directly. We considered this preferable to trying to alter the tools to a common spatial scale, which would have introduced additional sources of error and hampered our capacity to identify differences between treatments.

As part of our research project, we considered seeking feedback from practicing planners on the methods, results, and discussion, to further broaden the scope of enquiry, and its relation to urban planning practice. Unfortunately this was not considered within the bounds of the original research, proposal, nor subsequent iterations of this research paper as this would've required research ethics approval from our research institution.6In the future, this could form the basis for further research projects.

V. Conclusion

Given current pressures to accommodate growing human populations into our cities and towns, the need to adopt planning approaches that make use of existing tools to inform the decision-making process is critical. Within ecology and natural hazard management there are a number of existing tools available that can assist with quantifying potential impacts to a range of assets and ecological values under different planning scenarios. GeoDesign offers a new and integrated way in which disparate skill sets and disciplines can be combined together to achieve multiple outcomes. Although there remain difficulties in translating a theoretical concept across into every day planning practice, there are a number of useful starting points that our research has provided. Actively engaging in this process has provided a model example of the joint action required of a GeoDesign planning process, and given insight into how to make modelling outputs (and more broadly scientific data) clear and accessible, comprehensive, digestible (usually through dialogue) for planners, whilst also clarifying the role of planning regulation. Reflections on the necessary changes required of the Victorian planning scheme to permit this approach were discussed. One of the major hurdles to a more wide-spread adoption of incorporating scientific models into the planning process is the specialist expertise which is often required to run the models.

Overcoming this challenge will require ongoing dialogues between practitioners in many disciplines. However, starting these discussions requires knowing alternatives to the current system are possible, and our case study demonstrates how such a dialogue can proceed.

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[6] In addition, the ongoing uncertainty induced from the COVID-19 Pandemic would make expanding the scope of this research to include such feedback difficult to achieve within the permitted timeframe.

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Evaluation of Dye Bio-Sorption Properties of *Sphagnum Cymbifolium* (Moss) in Aqueous Solution by the Batch Process

By Idika Digbo I, Oguzie, E.E, Ogukwe, C.E & Victor Njoku
Babcock University

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Methods: The biomass was characterized by scanning electron microscopy (SEM) in order to examine the surface morphology of the biomass. The screened biomass samples were characterized at 1000 x magnification, 500 x magnification and 200 x magnification for their surface morphologies, This was done using a scanning electron microscope (FEI – inspect/ OXFORD INSTRUMENTS – X- MAX), which was equipped with an energy dispersive X- ray (EDAX) spectrophotometer employed for elemental composition analysis. It was equally characterized with Fourier transformed infrared spectroscopy (FTIR) spectrophotometer (Perkin – Elmer, England) in the wavelength range of 350 – 4000nm.

Keywords: *bio-sorption, sphagnum cymbifolium, batch process, sem.*

GJRE-J Classification: *FOR Code: 091599*

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Results: Results for the biomass surface morphology obtained through the scanning electron microscopy (SEM) showed the presence of pores. These pores represented sites where dye molecules could be trapped in the course of the adsorption. The results from the Fourier Transformed spectroscopy (FTIR) after adsorption show that C-H, C≡H, and C≡C, functional groups were responsible for the adsorption. The adsorption of methylene blue dye was found to be dependent on contact time, biomass dose, pH, temperature and effects of dissolved salts.

Conclusion: From the results obtained, it is clearly seen that methylene blue can absorb onto *sphagnum cymbifolium*(moss). It was equally discovered that all these variables contact time, biomass dose, pH, temperature and the presence of dissolved salts affected the rate of adsorption of methylene blue onto *sphagnum cymbifolium*(moss). In each of the analyses, three different experiments were performed, and the mean values respected with their standard deviations.

Keywords: bio-sorption, sphagnum cymbifolium, batch process, sem.

I. Introduction

Bio-sorption can be defined as the abstraction of organic and in-organic species. This may include dyes, metals, and odor causing substances using live or dead biomass or their derivatives. The above can be achieved either through the batch or fixed bed technique.

But, this research work is aimed at achieving it through the batch process.

The batch process of adsorption occurs as a result of agitation between the biomass and the dye solution. Such agitation is normally provided by a shaker or a magnetic sterner.

Synthetic dyes which include a wide range of aromatic water soluble dispersible organic colorants are used extensively in textile industries. Effluents containing synthetic dyes not only produce visual pollution, but also are hazardous to ecological systems and public health.

Conventional treatments of dye containing effluents are either in effective, costly, complicated or have sludge disposal problems [1].

Robinson *etal* [2] reviewed the current treatment technologies including bio- sorption with proposed alternatives for the removal of dyes in textile effluents.

Due to the increasing stringent restriction on pollutant contents of industrial effluent. Due to the increasing stringent restriction on pollutant contents of industrial effluents, it becomes very important to remove dyes from waste water before they are discharged the environment many low cost adsorbents including natural materials from industries and agriculture have been proposed by several workers [3, 4].

Some researchers reported the use of plant leaf biomass to adsorb heavy metals from solutions [5-7]. Limited work was reported on the bio-sorption of cationic azo dyes and other reactive dyes on fresh water algae [8, 9].

This work is carried out with the view of expanding the field of application of natural biomass for the treatment of dye waste waters, and also determine the adsorption capacity of *sphagnum cymbifolium* (moss) on to methylene blue dye. Since such an indepth study has not been done on this biomass, the results obtained from the work will add to the expansion of knowledge in this area.

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Author ω: Department of chemistry, Imo state university, Nigeria.

II. Materials and Methods

The methylene blue dye used in these investigations were obtained from qualikem laboratory, owerri Nigeria. Other necessary laboratory, Owerri Nigeria. Other necessary laboratory chemicals used were equally obtained from this laboratory.

The sphagnum cymbifolium (moss) used was obtained from ikorodu area in Lagos, Nigeria which is located within the following coordinates 6.6194°N and 3.5105°E. This sample was identified at the department of crop science at the federal university of technology, owerri, Nigeria with the voucher specimen number of FUT/CR/005/16.

The biomass was washed severally with distilled water to remove any dirt from it. The washed biomass was air dried for ten days until a constant weight was obtained. The biomass was grinded with a new sonic domestic blender to avoid any form of contamination. It was screened using 600-850 micro sized sieves and stored in air tight containers ready for adsorption.

The methods and techniques employed in these determinations are the standard methods which have been used by other researchers [10, 11].

III. Characterization of the Bio-sorbent

The surface structure and morphology of the sphagnum cymbifolium (moss) was characterized at 1000X magnification, 500X magnification and 250X magnification respectively for their surface morphology. This was done using scanning electron microscopy (SEM) (FEI- Inspect oxford instrument-x-max) which was equipped with an energy dispersive x-ray (EDAX) spectrophotometer employed for elemental composition analysis.

The biomass sample was further characterized for their fundamental functional groups before and after adsorption experiment using a Fourier Transformed Infrared (FTIR) spectrophotometer (Perkin- Elmer, England) in the wave length range of 350-4000nm using KBr powder and fluk a library for data interpretation.

a) Effect of Contact Time

Experiments were carried out by mixing 40mg of the biomass in a dye solution of 90mg/L. Agitations were made using a shaker at the range of 30-180 minutes at 250rpm. After the shaking, the sample was taken and centrifuged. The left out solution was analyzed for dye absorbance at 600nm in au.v spectrophotometer. These tests were carried out in triplicates and mean values with their standard deviations reported.

b) Effect of biomass dose

Experiments were carried out by mixing biomass of different doses (10-100mg) with a dye solution of concentration 90mg/L. Agitations were made for three hours in a shaker at 250rpm. The left out solution was centrifuged and subsequently analyzed in au.v spectrophotometer at 600nm.

c) Effect of ph

Experiments were carried out by mixing 40mg of the biomass in a 90mg/L dye solution at different pH range (2-11). After three hours of agitation in a shaker at 250rpm, the samples were centrifuged. The left out supernatant solution was analyzed in au.v spectrophotometer for dye absorbance at 600nm.

d) Effect of dissolved calcium chloride

Experiments were carried out by mixing 40mg of the biomass in a 90mg/L dye solution with varying amount of dissolved calcium chloride (0.10-0.20M). After three hours of agitation in a shaker at 250rpm, the samples were centrifuged and the left out supernatant solution analyzed for dye absorbance in au.v spectrophotometer at 600nm.

e) Effect of temperature

Experiments were carried out by mixing 40mg of biomass in a 90mg/L dye solution in a vessel placed in a magnetic hot plate. This was done in batches with the aid of a thermometer for the proper monitoring of the temperature. The temperature range was between (323-353K). After three hours of agitation in the hot plate at 250rpm, the samples were centrifuged, and the super natant solution analyzed for dye absorbance in au.v spectrophotometer at 600nm.

NOTE: The amount of dye adsorbed per gram biomass (q_e) was calculated using the equation below

$q_e = V (C_O - C_e) / M$

Where V= volume of samples in dm^3

C_o= Initial dye concentration in mg/L

C_e= Equilibrium dye concentration in mg/L

M= Mass of the biomass in g.

IV. Results and Discussion

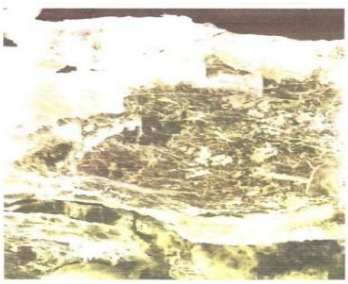

Fig. 1: SEM morphology of Sphagnum cymbifolium (moss) (X250)

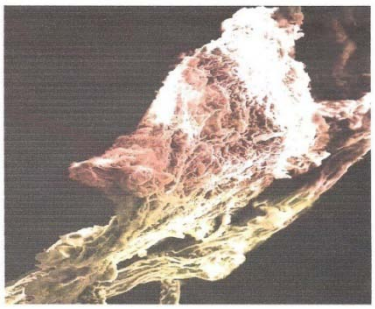

Fig. 2: SEM morphology of Sphagnum cymbifolium (moss) (X500)

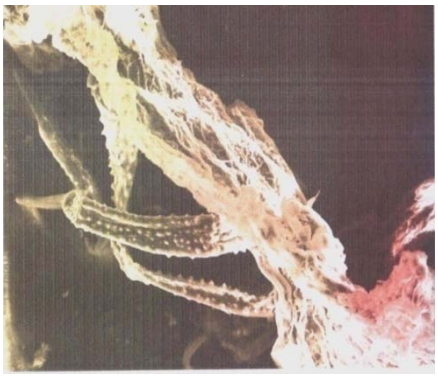

Fig. 3: SEM morphology of Sphagnum cymbifolium (moss) (X1000)

The SEM micrographs of Sphagnum cymbifolium (moss) shown in figure 1,2, and 3 above reveals the presence of unevenly dispersed cavities on the surface of the biomass. These cavities provide sites where the molecules of the dyes could be trapped in the course of adsorption. Similar cavities on biomass surface have been indicated by other researchers [12].

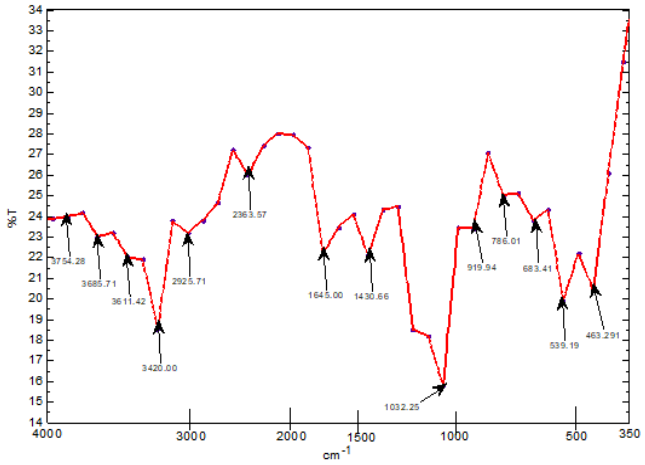

Fig. 4: FTIR Spectrum of Sphagnum cymbifolium (moss) before adsorption

The FTIR spectrum of Sphagnum cymbifolium (moss) before adsorption shown in figure 4 revealed the presence of five major functional groups. The functional groups include O-H or N-H at 3420nm, C-H at 2925.74nm, C≡N, C≡C at 2363.57nm, C=O, C=C at 1645nm and benzene at <1000nm.

Similar findings were reported by (Chiou and Hip, 2004) for the characterization of the biomass PadinaParvonica.

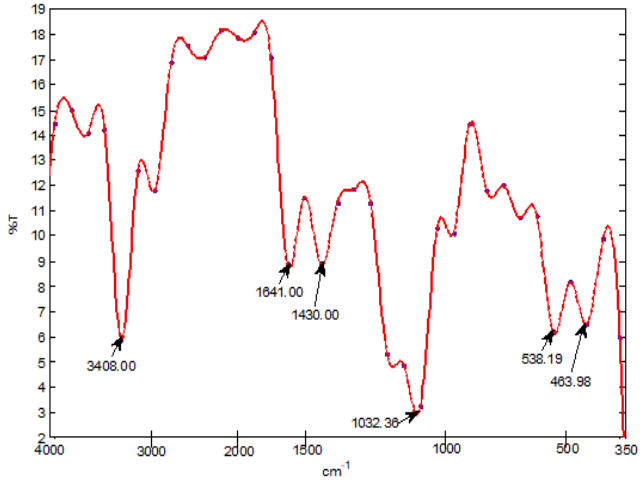

Fig. 5: FTIR Spectrum of Sphagnum cymbifolium (moss) after adsorption.

The FTIR spectrum of Sphagnum cymbifolium (moss) after adsorption as shown in figure 5 above was used to ascertain the functional groups that were responsible for the adsorption reaction.

The spectrum showed prominent peaks at 3406nm (-OH, -NH), 1642nm and 1429nm which are characteristic of the –CO functional group which strongly predict the presence of carboxylic acid group in the biomass with the adsorbed dye molecule. After the adsorption, there were some bond displacement of the original peaks indicating the functional groups that were responsible for the adsorption reactions. The displacements occurred at 2925.71nm and 2363.57nm which correspond to these functional groups, C-H, C≡N, and C≡C.

Furthermore, although the intensity of the peaks greatly decreased after the adsorption, the functional groups on the biomass did not disappear totally during the biomass characterization after the adsorption. This indicates that the interaction of the dye molecules with the *sphagnum cymbifolium* was merely a physical process.

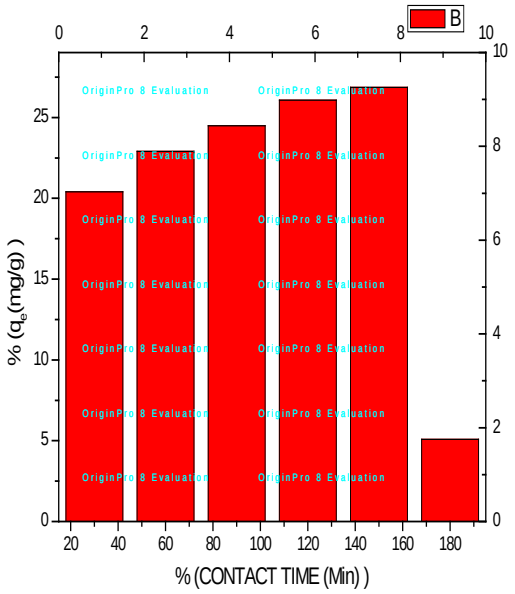

Fig. 6: Effect of contact time on adsorption.

As could be seen from figure 6, a two stage kinetic behavior is observed. A rapid initial adsorption over thirty minutes, followed by a longer period of much slower uptake as could be seen from figure 6 above. At the beginning of the adsorption, the value of q^e increased quickly, then 150 minutes later, the change became slow. Here, the reaction is assumed to have reached equilibrium.

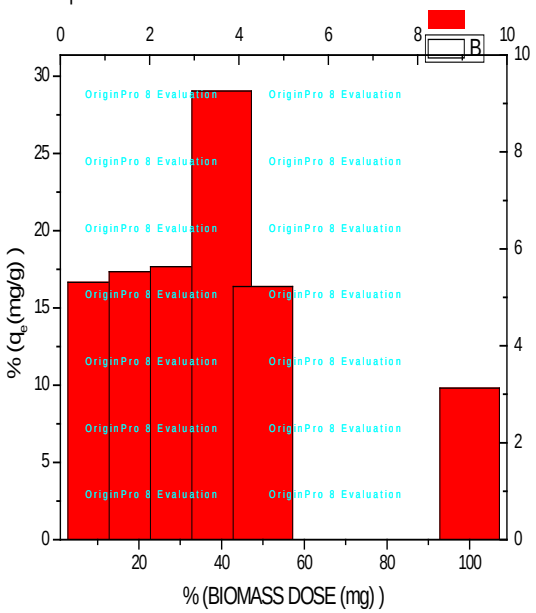

Fig. 7: Effect of biomass dose on adsorption

It was observed that the percentage removal efficiency of the biomass increased significantly when the biomass increased significantly when the adsorbent dose increased from (10-40mg). The value of qe decreased marginally when the adsorbent dose increased from (50-100mg). The primary reason for the above is that the adsorption sites remained unsaturated and the number of sites available for adsorption increased by increasing the adsorbent dose up to the adsorbent dose of 40mg. At higher adsorbent concentration, there is a fast superficial adsorption onto the adsorbent surface than when the adsorbent dose is lower. Thus, with increasing the adsorbent dose, the amount of dye adsorbed per unit mass of the adsorbent is reduced. A similar trend was previously reported by other researchers [13, 14].

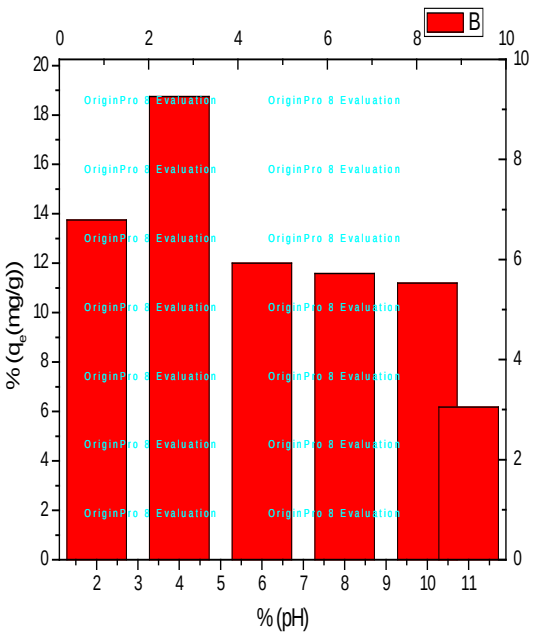

Fig. 8: Effect of pH on adsorption.

The rate of adsorption was found to be dependent on pH. A pH of 4 favored the maximum adsorption of the dye onto the biomass as could be seen in figure 8. Several reasons may be attributed to the dye adsorption behavior of the sorbent relative to the large number of active sites, and also the chemistry of the solution. At very low pH values, the surface of the adsorbent would be surrounded by hydrogen ions which compete with dye ions binding sites of the sorbent. At high pH values, the surface of the leaf particles may be negatively charged which engaged the positively charged dye cations through electrostatic forces of attraction. Similar situation were reported by other researchers. (vennapusaetal 2008).

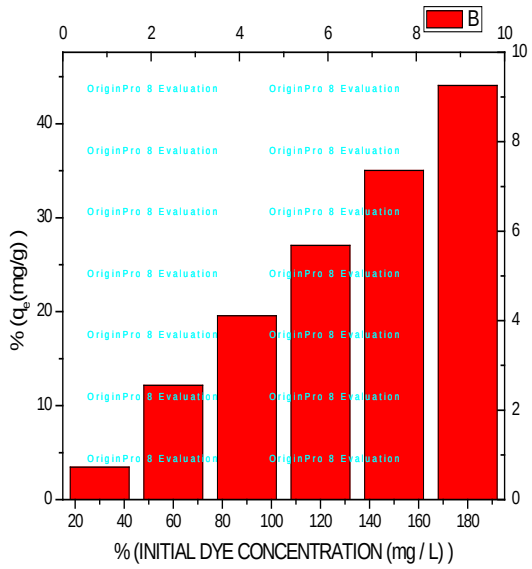

Fig. 9: Effect of initial dye concentration

As could be seen from the figure 9, the equilibrium uptake increased with the increase of initial dye concentration at the range of experimental considerations. This is as a result of the increase in the driving force from the concentration gradient. In the same conditions, if the concentration of the dye in solution was bigger, the active sites of the biomass will be surrounded by much more dye ions. The process of adsorption would carry out more sufficiently. So, the values of q_e increased with the increasing of initial dye concentrations. Other studies have revealed the same pattern of result about initial dye concentration. (vennapusaetal 2008).

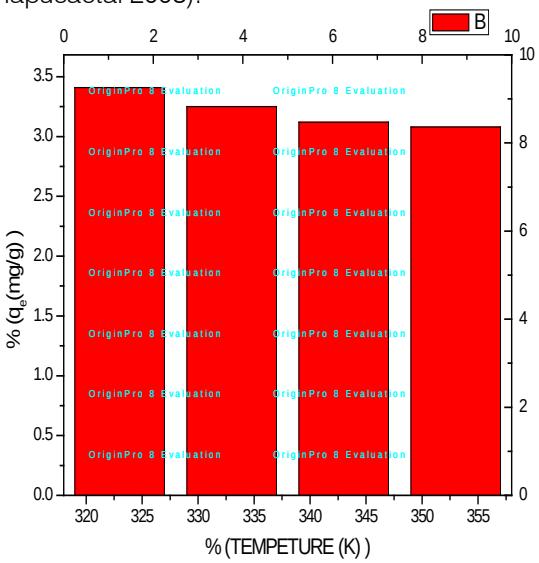

Fig. 10: Effect of temperature

Figure 10 shows the effect of temperature on adsorption. It was observed that the value of q_e decreased with increase temperature. This could suggest that the adsorption process may be a physical process. A similar trend was observed by other researchers.

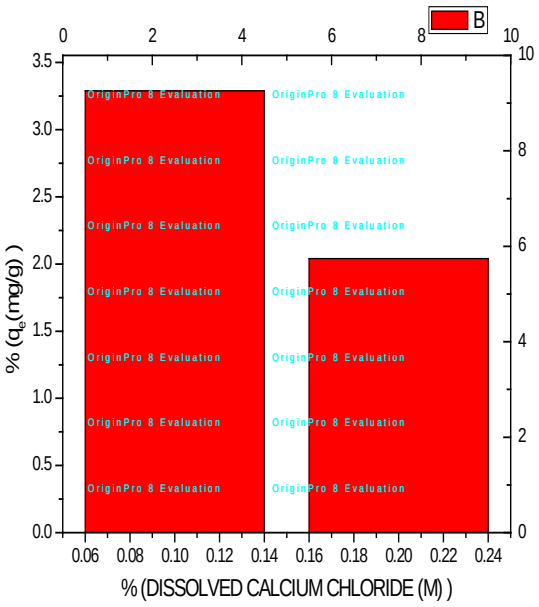

Fig. 11: Effect of dissolved salt on adsorption.

Figure 11 shows the effect of dissolved calcium chloride on q_e. The waste water containing dye has commonly higher salt concentration. The effects of ionic strength are of some importance in the study of dye adsorption onto biomass. It was seen that the increase in salt concentration resulted in the decrease of the values of q_e, and the percentage removal efficiency. This trend indicated that the adsorbing efficiency decreased when calcium chloride concentration increased in the dye solutions. This could be attributed to the competitive effect between the ions and the cations from the salts for sites available for the salt increased from 0.10m to 0.20m, the q_e values decreased to lower values.

V. Conclusions

From the experimental results, *sphagnum cymbifolium* (moss) could act as a good bio-sorbent for the removal of methylene blue dye in aqueous solutions. It was equally observed that lower pH value favored the adsorption of methylene blue dye onto the biomass. The values of q_e were found to be dependent on the solution pH, biomass dose, contact time, salt concentration and initial dye concentration.

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The Justification of Secession: An Argument from G. H. Von Wright's Philosophy of Action

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Abstract- Secession is one of the major issues in contemporary politics. Regarding its analysis, three main approaches have been developed: the conflict-oriented approach, the right-oriented approach and the dynamic-oriented approach. In this paper, my main interest is with the second approach that is the right of the group that decides to secede to do so. I am analyzing the question here from a logical point of view, from the angle of arguments for secession. An argument is fomulated from G. H. von Wright's philosophy of action. The argument, constructed from three ingredients - namely a first-person practical inference, a minimal concept of change and a theory of anti-determinism - shows that secession is justified because man is free, which includes the freedom to leave the political union. The paper ends with some recommendations on how secession could be prevented.

Keywords: *secession, action, determinism, freedom, right, G. H. von Wright.*

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I. Introduction

Secession is one of the major issues in contemporary politics. Recent and current cases illustrate this: Catalonia in Spain, Kashmir in India, Hong Kong in China, Scotland in the United Kingdoms, Kurdistan in Iraq, Abkhazia in Georgia, Ambazonia in Cameroon and Tigray in Ethiopia, etc. Ashan Butt observed three years ago that in the last seven decades, there have been about twice as many nationalist civil wars (ninety-five) as interstate wars of any kind (forty-six), leading to the conclusion that such wars, often called secession wars, are the "chief source of violence in the world today." (Butt, 2017, pp. 2-3) This does not mean that secession is always synonymous to war, as we can see for instance from the recent cases of Quebec, Catalonia or Scotland. But even when there is no war, the intensity of violence and disagreement shows that breaking up is hard. A detailed analysis of secession must be multidimensional, and it is almost certain that this cannot be done in a paper. Three major approaches have been developed: the conflict-oriented approach, the right-oriented approach and the dynamic-oriented approach. Under the first approach, "One cares about how the interplay between internal actors and external actors would affect conflict settlement" (Lu, 2018, p. 6). With the second, the main question is about the right of the group that decides to secede to do so (Busquets, 2020; Kohen, 2006). Lastly, the dynamic-oriented approach aims at understanding the phenomenon of secession proper, through the question: why do people desire to secede? (Bartkus, 2004; Casertano, 2013) In this paper I am not concerned with the first approach. I am mainly interested with the second approach, and incidentally with the third one. More precisely, I am analyzing the question here from a logical point of view, that is from the angle of arguments for secession. In this line, secession is an interesting object of analysis for the logician since it represents an extreme case of disagreement among people, entailing a necessary "conflict of commanding wills" to use von Wright's terminology. (von Wright, 1963,p. 203) Butt defines secession as a demand by an ethno-nationalist group for either independence from, or significant regional autonomy *within*, a modern nation-state (Butt, 2017, p. 3). This definition is reductive as it does not capture recent movement many of whom are multi-ethnic. By secession, I will mean, broadly, the act of withdrawing from membership of a political union, irrespective of the *homogeneity* of the group that decides to initiate the action. My choice of using G. H. von Wright with relation to arguments for secession is motivated by the fact that his position also sheds some light on the roots of secession, which means that if his view is well articulated, it might help to understand the phenomenon of secession more generally and perhaps to see how it can be prevented. I will begin by highlighting the unresolved question of the right-oriented approach which motivates a new answer to the question. And then, I will try to construct von Wright's answer to that question. Lastly, I will show, through some concluding remarks, how von Wright's view can be used to prevent secession.

II. The Justification of Secession: An Unresolved Question

Much of the debate about secession focuses on issues of right, both philosophical and legal. As the title of a recent book, *Morality and Legality of Secession* (Busquets, 2020) rightly summarizes the debate, secession is mostly seen under the angle of its evaluation from a moral and a legal point of view. Unfortunately, this right is never guaranteed at the national level. As Riegl and Dobos (Riegl & Dobos, 2017) have indicated, the right to secede is not recognized under context others than colonization.

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Recent secession movements are not to be classified under the colonial category as they are internal conflicts, what Philip Roeder calls national secession (Roeder, 2018).

From a moral point of view, it has been claimed that secession should be based on the principle that each people has the right to self-determination. In turn the right to self-determination is guaranteed by legal texts under international law. There is then a circular justification of the right to secede. If morality is to be guaranteed by the law, it is by no way natural, that is why it becomes an argumentative issue. The problem, however, is that in matter of arguments, international laws generally conflict with internal laws. Most often, the right to secede is not internally recognized. This is what we may call the dilemma of secession. The dilemma runs thus: arguments for or against secession seem to necessitate a choice between two norms, the norm that there should be a territorial integrity for the State to be sustained and the norm that people should freely choose and control their destiny. In other words, the territorial integrity principle can only be maintained through a certain control by the central government on the lives of the communities and the citizens, that is, with the rejection of their right to self- determination.

However, as no state will ever grant autonomy without any violence, issues of right becomes useless to understand the roots of secession. As Ahsan I. Butt (Butt, 2017) lucidly puts it, the level of violence of the central state in responding secession initiatives is proportionate to the consequences, in terms of the stability of the state, of the secession act. And this violence is often conducted with clear violations of international laws. This shows enough that the legality which is supposed to guarantee the morality of secession is flawed and makes the question of the justification of secession unresolved.

Some authors have seen it right that the problem may be resolved by simply shifting the attention from issues of justification. In a book that announces this shift (Closa Carlos et al. (Eds), 2019) from *moral* to *amoral* considerations about secession, Carlos Closa says: "We use amorality in order to escape the terrain of the justification of secession." (*Ibid.*, p. 1) It is then surprising to see the following assertion, just on the next page: "Despite the different approaches taken by the contributors, the connecting thread linking the chapters of the book lies in the critical distinction between the 'democratic theory of secession' and the 'theory of democratic secession'" (*Ibid.*, pp. 1-2). This is quite surprising because the definitions of "democratic theory of secession" and "theory of democratic secession" seem to indicate that the issue of justification has not been evacuated. Here are the definitions:

> The democratic theory of secession argues the existence of a fundamental value which ultimately justifies secessionist claims, in a sort of "teleological justification" (…) while the theory of democratic secession legitimates relying on procedures, that is the instruments used to achieve secession (*Ibid.*, p. 2. My emphasis.)

Now I wonder whether these two theories escape the original problem. I think they do not. Therefore, our authors are very prompt, after announcing that they are trying to escape the justification approach, to tackle the problem of secession from the point of view of political philosophy and from the point of view legal theory.

Let's follow them on these points

We will begin with the legal theory, just to recall a point we mentioned earlier. This is the contradiction between international law and internal law. The question here is: if there are international laws that guarantee people's right to self-determination, why does secession always go with violence?

My answer is that while the international law guarantees secession from a country formerly under the rule of a colonial power, it does not guarantee anything when it comes to secession that does not imply any foreign country. If colonies were free to break from the colonial master, it seems that communities are not allowed to break from the central government. This is the principle of the integrity of the state. Of course, we should make the difference here between natural and artificial or political freedom.

Debates on secession, at a political level, do not make clear the type of freedom they talk about. Some contract theorists think that individuals give up their natural freedom to gain an artificial freedom in the contract. However, as Rousseau pointed at the opening of his *On the Social Contract*, "Man is born free; and everywhere he is in chains." (Rousseau, 2003, I, 1). This shows that the artificial freedom here is not freedom at all (at least, in the mind of a contractualist like Rousseau). I suspect that political communities have later confused between this artificial slavery and natural slavery. That is why they resist whenever some members of the community want to leave.

From observation, modern political communities tend to rely on the naturalness of the State, both historically and geographically. But at the same time, they seem not to be ready to totally endorse this position since they will rely on the national constitution, which very often defends the principle of territorial integrity, to override people's right to leave. It may sound contradictory, but it is not. The artificiality of the state obtained as the result of a social contract quickly changes to become natural. One will not doubt this if he observes for instance the treatment that was given to those who threatened the sacred character of the society.

Indeed, it seems to be a common fact among contractualists to accept death penalty when the society's harmony is threatened. Consider the following examples.

Though Locke admits the right to revolution (Locke, 1980, § 224), he linked the death penalty to natural law:

> In the state of nature, has a power to kill a murderer, both to deter others from doing the like injury, which no reparation can compensate, by the example of the punishment that attends it from everybody, and also to secure men from the attempts of a criminal, who having renounced reason, the common rule and measure God hath given to mankind, hath, by the unjust violence and slaughter he hath committed upon one, declared war against all mankind, and therefore may be destroyed as a lion or a tyger, one of those wild savage beasts, with whom men can have no society nor security. (*Ibid*., § 11)

As this suggests, the political society that is born of the social contract inherits this natural right of self-defense and can make use of it by eliminating a criminal for the common good.

Montesquieu, following Locke, also places capital punishment in the perspective of natural law. Attaching the principle of retaliation to the "relations of equity prior to positive law", he concludes: "They are a kind of retaliation, by which the *society* refuses security to a member who has actually or intentionally deprived another of his security. These punishments are derived from the nature of the thing, founded on reason, and drawn from the very source of good and evil." (Montesquieu, 1777, XII, 4).

Rousseau, too, does not question capital punishment. In *On the Social Contract,* he considered it to be justified by a clause implicit in the founding pact (or "treaty"), a clause which he formulated as follows:

> Again, every malefactor, by attacking social rights, becomes on forfeit a rebel and a traitor to his country; by violating its laws, he ceases to be a member of it; he even makes war upon it. In such a case, the preservation of the State is inconsistent with his own, and one or the other must perish; in putting the guilty to death, we slay not so much the citizen as an enemy. (Rousseau, 2003, II, 5)

I don't know if these elements are convincing enough to justify the rejection of the right to secede, but I suspect that they have deeply contributed to the focus on the right aspects of secession analysis. However, as I said earlier, we should not much rely on law when talking about secession. Internally, the right to secede is never guaranteed, externally, secession wars hardly motivate external interventions. Roeder gives some interesting data to support our view here. Between 1945 and 2010, there has been 171 national secessions around the world, with only 26 successful. More important, out of the 26, only 7 have motivated external intervention namely Bangladesh, Bosnia, Eritrea, Kosovo, Montenegro, South Sudan, and Timor Leste (Roeder, 2018, p. 30)

Given that the question of justification (both legal and moral) has not been given a definite answer, should we conclude that there is no convincing answer to the question? G. H. von Wright's philosophy of action seems to offer an acceptable solution to the problem. I shall now turn to examining his view.

III. Von Wright on the Right of Secession

There are at least three reasons why one may be surprised to see G. H. von Wright's philosophy applied to the question of secession: 1) to my knowledge, the term "secession" does not appear in any of his writings; 2) by his insistence on the norms as being legal (the obligatory, the permitted and the forbidden), he seems to give a preference to legal normalcy, which rejects secession as we said earlier; 3) von Wright puts much emphasis on the individual action, and since a person alone cannot decide to secede, it is difficult to see how any analysis of the individual action may help to understand a collective action like secession.

However, against 1), the expression "self-determination" appears at different places in his writings (von Wright, 1998, pp. 6, 12-14, 31). Against 2), we could say that "there is a sense in which the human individual can 'break' the rule of custom and in which the course of nature cannot 'break' its (causal or statistical) laws." (von Wright, 1963, p. 8) And this should be coupled with another assertion found in the article "Laws of Nature": "Knowledge of laws of nature should not count as genuine 'knowledge of the future'" (von Wright, 1984, p. 145) which shows that even the regularities in the natural laws are not immune to future refutations; they are, von Wright would say, "open" (*Ibid*., p. 146). Against 3), it suffices to indicate that collective actions are reducible to the action of individuals (von Wright, 1963, p. 77).

This means that though G. H. von Wright has never expressed any argument for or against secession, some points of his philosophy may be put together to analyze the issue of justification of secession.

a) The primacy of the individual

In *Practical Reason* (von Wright, 1983), von Wright sets himself the task of elaborating a theory of practical inference by developing the practical syllogism already put forward in Aristotle's *Nicomachean Ethics* (Book Seven) through the concept of "deliberate choice" and by sorting out the invariants of all human action. In fact, the two projects are carried out simultaneously in the book since it is the development of the practical

syllogism that allows it to bring out the invariants of all human action.

A deliberate choice, he says, involves three elements: an end to be achieved (x), an action to perform in order to achieve that end (y), and finally the establishment of the necessity of the action to be carried out. The scheme of a practical inference is therefore as follows:

x is an end to be achieved
x cannot be achieved unless y is accomplished.
So, y must be accomplished (Ibid., p. 2)

For example:

A person wishes to make a house habitable
But the house cannot be made habitable if electricity is not installed. So, we must install electricity in the house.

There are some difficulties to be noted at this level.

- The first is that of the difference in nature between the premises and the conclusion, the premises being descriptive and the conclusion imperative. There are doubts about the validity of a first-person inference, at least as formulated above.
- Another difficulty is the determination of the unavailability of another action to be accomplished to achieve the desired end. If there is indeed more than one way to achieve this end, there can no longer be any need to perform the indicated action, but another action could just as easily be performed in order to achieve the same result.
- A third difficulty is related to the passage from the necessity of the action to its performance. Even if one derives an imperative conclusion from descriptive premises indeed, it does not follow that the action thus indicated in the conclusion will be accomplished.

Let's start with the last difficulty. This difficulty may only be for third person practical syllogisms. For the first person, it is obvious that if I identify an action as the means by which I must achieve an end that I desire to achieve, I will necessarily accomplish the action, unless I am prevented from doing so by a force above my own. Given that all action is always the action of an individual, even in the case of collective actions. It follows, then, that practical inferences are first-person inferences and their conclusions are actions. This elimination of practical inference in the third person allows von Wright to formulate, after Kant, the first principle of practical inference: *whoever wants to achieve an end must also want to use the means necessary to achieve that end* (*Ibid*., p. 9).

In this line, von Wright highlights a few determinants of human action and notes that the most important is the agent's aptitude to perform an act. The aptitude determines the action negatively, by placing restrictions on it (*Ibid*., p. 48). An action may be intentional and conform to social norms, but it is only made possible by the agent's ability to perform it. Von Wright adds to this third invariant a fourth one, the opportunity, which he presents, however, as an occasional determinant. Opportunity determines concrete action by being states already present or absent. Suppose, for example, that my intention is to open a window and that this window is already open.

The opportunity to open an already open window disappears and the action then becomes impossible.

The most important factor in determining the action is the ability or inability of the person acting to perform it (von Wright, 1998, p.3). And the modalities of capacity or incapacity are learning, difficulty, means, permission, right, aversion, opportunity, time and obstacles. I may be unable to do a thing either because I haven't learned it, because it presents an internal difficulty, because I don't have the means to do it, because I don't have permission, because I dislike it, because the opportunity to do it doesn't present itself, because I don't have the time, or because obstacles stand in my way (*Id.*). A distinction must be made between those modalities that apply to generic actions, i.e. actions that I cannot take in general because I have not learned to do them, and those that apply to individual actions because I do not have the means to take the action in question or because obstacles stand in my way. We can call the first generic modalities and the second individual or restrictive modalities. This distinction is important because it shows that one can be called upon to take an action that one can take generically, but that one cannot take individually. Also, individual modalities take precedence over generic modalities (the main one being the learning modality) because they ultimately determine the reasons why an agent has or has not acted.

b) A Minimal Conception of Change

Von Wright identifies three types of facts: states of affairs, processes and events (von Wright, 1963, p. 26). He excludes the last two types of facts from the logic of change because, for them to be otherwise, we would have to consider a time and space other than those in which they take place or have taken place, and that, in lending ourselves to such a game, the result will not be different in any case. But even if he rejects them, he nevertheless thinks that they can be taken as moments of a special kind of description of states of affairs. Consider a simple gesture such as opening a window. This opening can be described as a transition or process of change that took place between two business states, an initial state (or event) in which the window was closed and a final state in which the window is open. Demonstrating the interdependence between these three types of events will allow von Wright to introduce an important symbol of the logic of change, the symbol of transformation/transition or T.

The use of T is done by inserting it between two states of affairs, each representing a generic proposition, the initial and the final, and to show the passage from one state to another. Suppose for example that f means the window is closed and ~f the window is open (or not closed). We can then symbolize the opening of the window by fT~f (the transition of the states from the closed window to the unclosed window) or the closing of the window by ~fTf. Likewise, "the window has remained open" may be represented by ~fT~f and "the window has remained closed" by fTf. The four symbols we have just presented, fT~f, ~fTf, ~fT~f and fTf, represent the four elementary and exhaustive transformations of the logic of change. Von Wright gives the reason for this in these terms:

> On a given occasion the world either has the feature described by p or it lacks it; if it has this feature it will on the next occasion either have retained or lost it; if again it lacks this feature it will on the next occasion either have acquired it or still lack it. (*Ibid*., pp. 29-30)

What is important to remember about the logic of change is that, by going beyond static logic, it puts forward the concept of freedom. This leads us to another central point of von Wright's philosophy, that of the Necessity of Freedom.

c) The Necessity of Freedom

Von Wright defends a compatibilist theory of freedom since he defends that human freedom is compatible with determinism. Here is a passage that nicely summarizes the position:

> I have already argued that whereas one can be by physical obstacles prevented from doing various things – as, for example, a chained prisoner from escaping – and thus compelled to forbearance, one cannot rightly be said to be physically compelled to do anything, and therefore one cannot be physically prevented from forbearing anything either. This is a noteworthy asymmetry inherent in the concept of free action. (von Wright, 1998, p. 6)

Rosaria Egidi said that this version of compatibilism is "very special" because it is the result of a dynamic vision in which man is "an agent who is at once the subject and the object of the natural forces he controls and by which he is controlled" (Egidi, 2016, p. 124). The particularity of von Wright's compatibilism is that it claims, as Egidi has indicated, that "man without nature could not be free" (*Ibid*., p. 125).

To understand this special version of compatibilism, it is from 1971 onwards that this question must be explored in von Wright's writing. That year was marked by the publication of *Explanation and Understanding* (von Wright, 1971), which was completed three years later by *Causality and Determinism* (von Wright, 1974). Both works aim to promote the same thesis, according to which one cannot speak of a universal determinism on the scale of human action.

The first book is mainly a conceptual clarification whose aim is to show the difference between the natural sciences and the humanities, in order to avoid the confusion often made between explaining a phenomenon and understanding it. It is often accepted that understanding a phenomenon means being able to explain it, just as explaining a phenomenon means having understood it. For von Wright, however, these two verbs mark an epistemological difference with immense implications. The natural sciences, he says, are based on the principle of explanation, while the humanities are based on the principle of understanding. The fundamental difference that leads to this distinction is the fact that the social sciences and humanities study a being endowed with an intention, a being that carries meaning and therefore acts according to the goal it has set for itself. The teleology of human action is therefore what gives it a fundamentally different trait from other actions that one can have in the world.

One can understand von Wright's position by going back to the conceptual clarification he makes in Chapter III, which leads to the assertion that the human sciences do not provide causal explanations (von Wright, 1971, p. 153). To understand this proposition, one must distinguish between a number of concepts, causal explanation, teleological explanation, quasi-causal explanation and quasi-teleological explanation. And when defining these concepts, one must keep in mind that they are situated within the framework of von Wright's temporal logic. Causal explanations refer to the past and try to retrace the circumstances preceding the occurrence of a state of affairs and on which this occurrence could depend. There is a causal relationship between the antecedent and the following one. Teleological explanations exhibit the same connection between two states of affairs except that they refer to the future, for which an action was taken by an agent, his intention. Some causal explanations are given in the form of teleological explanations, which are then quasi-teleological explanations. Other teleological explanations, on the other hand, are formulated in the form of causal explanations, they are quasi-causal explanations. There is therefore a parity relationship between causal and quasi- teleological explanations, on the one hand, and teleological and quasi-causal explanations on the other. Von Wright explains the difference in the following terms:

> A conceptual difference between causal and quasi-teleological explanations, on the one hand, and quasi-causal and teleological explanations, on the other hand, is thus that explanations of the former type depend for their validity upon the truth of nomic connections whereas explanations of the

latter type do not – at least not in their overt form (*Ibid*., p. 85).

Although the examples taken by the author to illustrate these differences are sometimes difficult to untangle, it seems more important to understand the point here: to show that there are things that depend on us and that we cannot, by invoking the principle that we would be manipulated, remain passive and observe the course of events unless it is intentional. Once again, the author convokes the difference between the experimental sciences and the humanities to support his position. He explains that the systems that the experimental sciences study can be manipulated by an external agent. This agent has learned how to reproduce the initial states of systems under conditions where they would not otherwise have come into existence. The systems studied by social scientists cannot, as a rule, be manipulated by external agents; instead, they can be manipulated by internal agents (*Ibid*., p. 164).

This point is important for understanding von Wright's overall project since it marks a reversal of the situation; instead of using determinism as an excuse to claim agent irresponsibility, the author uses it instead to reinforce the idea of absolute agent responsibility. The fact that the agent acts intentionally and that a teleological explanation for his action can always be provided shows that the agent's behavior can always be explained and, therefore, that he can be held accountable for it. A deterministic position, he notes, far from calling into question the idea of responsibility, is on the contrary necessary to justify it correctly (*Ibid*., p. 166).

The conceptual arsenal used by the author to defend his thesis of the absolutely responsible agent consists in replacing the idea of cause, by the idea of condition. On the basis of this remodeling, von Wright asks himself the question whether a human agent can be the sufficient condition by which an event occurs in the world and answers in the affirmative. And he explains it more concisely by showing that anti-determinism is built by isolating a part of the world on which we act voluntarily and present as responsible for effects that without our intervention would not be present. The idea that causality is possible on the scale of a portion of the world is crucial because it allows von Wright to recognize that not all causes are attributable to man since there are many points in the universe in which man's intervention is almost absent. The idea of causality does not presuppose *a priori* the human will. This nuance allows von Wright to dismiss as a justification of determinism the non-correlation between the will of a man and the order of the world. Instead, he insists on the idea that this will can be exercised locally.

Accordingly, the world is organized into small worlds or systems in which an agent can intervene for a specific system without ever being able to act on all these systems at once (*Ibid*., pp. 81-82). Thus, even if we cannot act on the world as it is globally, it does not mean that we are entirely passive on the course of the world. Von Wright argues that our answer to the question of how we learn to isolate a fragment of world history into a closed system and to know the possibilities (and necessities) that govern developments within a system is as follows:

> We learn this partly by repeatedly putting the system in motion through acts of producing its initial state and then watching ("passively") the successive stages of its development, and partly by comparing these successive stages with developments in systems originating from different initial states. (*Ibid*., p. 64)

The illusion has been nourished, von Wright notes, by our tendency to think, that man in a state of pure passivity, simply by observing regular sequences, can record causal connections and causally related chains of events that, by extrapolation, penetrate the universe from an infinitely distant past to an infinitely distant future. This perspective fails to notice that causal relationships are relative to fragments of world history that have the character of what can be called closed systems (*Ibid*., p. 82). The main idea of *Explanation and Understanding* is therefore that since we are part of a system on which we can intervene, we are ultimately responsible also if we do not act. If we stick to the author's definition of restraint, an intentional passivity (*Ibid*., p. 90), we must then conclude that, for him, we are in any case responsible for what happens in our system, either by intervening in it or by refraining from intervening in it.

In *Causality and Determinism*, the author extends his argument by focusing this time not on the notion of causality as such, but on the link that can exist between this idea of causality and the affirmation of a universal determinism. Indeed, von Wright's aim is no longer to make a difference between causality in the experimental sciences and causality in the humanities. He now wants to devote himself exclusively to causality on the scale of nature in order to show that such causality does not in any way imply a universal determinism, particularly on the human scale. He points out that the concept of causality is intrinsically linked to the theory of human action. He also notes that this conception of causality is based on an atomic organization of the world in which independent states of affairs are linked in the logic of succession that the author calls the logics of tomorrow and yesterday. Finally, he leads a fierce struggle against determinism whose veracity, he says, must remain an open question. The argument of this second work is summarized as follows from the first pages of the first part: "*And this implies, as I shall try to show, that the idea of causal determinism, associated with this idea of causation, can*

claim validity only for limited portions of the world, and not for the world as totality." (von Wright, 1974, p. 2)

There is thus, in the background of these two works, a critique of determinism. The major idea of determinism, that there are no causal alternatives in the development of the world outside the internal necessity of the world itself, is strongly questioned by von Wright, who sees in this the idea that the world is governed by laws against which no intrusion is possible. Determinism advocates a linear view of time. But as our author notes, a difference must be made between an ontic determinism and an epistemic determinism. His argument could be schematized as follows:

The world would be entirely determined if we knew it in its entirety and not only in certain parts.
We do not know the whole world, but only parts of it.
It follows that the world is not entirely determined.

One could well admit an ontic determinism, following the model of a universe previously organized by a divine intelligence, which surpasses the human intelligence and finally makes that, all that men do and believe to act freely must finally be located in this project conceived before their existence. But such determinism cannot exclude human action, for men do not share with God the same form of intelligibility. On a human scale, some things are known, and others are not. An epistemic determinism implying that men necessarily know what tomorrow will look like cannot be admitted on a human scale. Now, since it is not on the divine scale, but on the human scale that action matters, it must be concluded that there is no determinism. Or, to use von Wright's schema, the fact that there is an ontic determinism does not in any way preclude an epistemic indeterminism. For our author, therefore, the defenders of the thesis of determinism on a human scale make a serious confusion between what man knows and what he does not know. The fact that man has more or less specialized knowledge on a small scale of the universe does not make him a being whose intelligibility can extend to the entire universe. It seems clear to us that it is this idea that von Wright wants to express by the formula that determinism can only be established on the scale of fragments of the world (*Ibid.*, p. 136).

He even goes so far as to suggest that epistemic determinism should rather make us optimistic, because it teaches us that there are fragments of the world that we can know and therefore act upon. That these actions are within the logic of an intelligence which is superior to our own is not something we should be concerned about. There is thus, in von Wright, the idea that epistemic determinism, considered in a fragmentary way, creates epistemic indeterminism, considered in a global way, and finally creates ontic intrusions. This is what he summarizes in the last paragraph of the book when he states that *"What action presupposes is only the epistemic certainty which, as long as it is not undermined, entails belief in the ontic contingency of some changes and thus takes for granted a certain margin of indeterminism in the world*." (*Id*.)

How should we interpret these views, in relation to secession?

Secession is generally considered unjustified because it threatens the harmony of the collectivity by promoting locality instead of nationality.

Let's examine a) above. We have seen with von Wright's conception of practical inference that an action is ultimately individual, even when it takes place in a given community. And there are indicators that this individualization of the human action is nothing but normal as human beings act essentially at the local level. I agree that there is some kind of reductionism here. However, we can easily understand it as the goal of the action is put first in the practical inference and has greater chances to be achieved if the action is performed at a local level. With the minimal conception of change defended by von Wright, basic actions are the most important as they bring the most observable changes or consequences in the world. This is to say that, the promotion of the local in place of the national is in no way abnormal. And if this might lead to secession, then secession is normal too. Many arguments in favor of secession hold this fact that the actions at more local levels have more impact than actions at national level for actions are performed here in such a way that we can see the results and, more important, we act with close people whom we trust. As Buckley defends:

> If we split apart, we'd be more likely to find ourselves living with people whom we trust and with whom we share bonds of solidarity. We'd be more prosperous, since we'd find it easier to rely on people to keep their promises, and we'd be more willing to look after each other with generous social welfare programs. (Buckley, 2020, p. 26)

As for the second point, we have seen that there are no conditions of freedom. In von Wright's view, freedom is absolute. Arguments against the justification of secession often claim that once the constitution is established, people are not free to leave. But we have seen with von Wright that determinants of action which include the permission and the right to perform a certain act are axiologically less important than the agent's aptitude to act. And this aptitude, if it is not materialized at the national level, can still be perceived and implemented at the local level.

Now I agree that these arguments will hardly be new. Then, how do they help in understanding the desire to leave? The answer is that we should distinguish between social and natural normalcy.

Generally, secession is socially abnormal. This comes from the fact that the norms of a society generally put that society above the individuals. Even in the case of anonymous norms such as the customs, it is

clear for individuals that some actions are forbidden, even if they don't know how the forbearance came about. When the custom becomes a prescription, and is clearly indicated in the legal code, its normative pressure is even more important as the sanction is already existing to punish the malefactors. The necessity of sanctions here is very much in line with von Wright's view. As he recommends in *Norm and Action*,

> "it is essential that the authorities should be able to back their prescriptions to the citizens with effective threats of punishment in case of disobedience. When this condition is not fulfilled the legal order collapses or dissolves, as when there is a successful revolution." (von Wright, 1963, p. 128)

Socially then, the normalcy of secession is hardly established.

But the problem with this reductive perception of normalcy is that it does not recognize what individuals are naturally able to do. Naturally, as we have indicated, the laws of the humanities are norm-like propositions, different from natural norms (*Ibid*., pp. 8-9). Freedom as a natural determinant in von Wright's conception takes precedence over social norms. This is the shift one must understand to be able to aptly appreciate the justification of secession. The fact that individuals are free also means that they are free to leave, even with the forbearance of the norm authority since the human norm is not above the nature's norm.

To summarize the argument then, secession is justified because human beings are free and because the social norms that see secession as abnormal are subsumed to the natural norms that bring that freedom to the fore.

Now that we have shown the normalcy of secession from von Wright's philosophy of action, what do we learn from this, as far as the roots of the secession are concerned? This is the question I will answer in the concluding remarks of this paper.

IV. Concluding Remarks: Understanding the Roots of Secession

My concluding remarks will consist of four points:

(1) We have seen that the individual is free and responsible. This means that the paternalistic attitude should not be promoted in politics. Paternalism here refers to the tendency to think that the rulers are necessarily more informed than the governed and therefore that they know best what the population needs. Through this tendency, many political leaders tend to underestimate the people, which leads to a clear break between elites and the rest. This break is the reason why the rulers feel less and less concerned with the future of the people and are more inclined to take arbitrary laws.

(2) As the practical inference is valid for the first person, it becomes crucial to lay emphasis on the individual's place in the society. This seems paradoxical, but the collectivity is maintained when the individuals feel valued. Besides, practical inferences show that individuals are rational as they carry calculation of the means corresponding to the ends. If this is so, then irrational norms, that is norms that are arbitrary, cannot stand for long as they are constantly challenged by rational agents to whom obedience is requested. The existence of norms and their preservation presupposes the rationality of those norms as well as that of the normative authority and agents. And this is possible only if the normative authority drops the paternalistic attitude described in (1) above.

(3) Given that change is, first, initiated at the individual level, it gives an indication about the fact that the locality must be promoted when it comes to resource exploitation. The resources of the community must first benefit the local community.

(4) Lastly, the existence of freedom despite the constraints gives some hope that we can do something. Secession indicates that people have lost hope in the future, that they think it is their duty to find a better place where they will bring that hope back. This is the sign that secession is painful for those who want to secede. They are ready to take the risks of losing so many lives without any guarantee of success only because the despair is already greater than the benefits of staying together.

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Impact of Flow Rate and Bed Height on the Fixed Bed Adsorption of Methylene Blue Dye on to *Sphagnum Cymbifolium*(Moss)

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Abstract- *Objective:* This work is aimed at expanding the field of application of natural biomass for the treatment of dye waste effluents. It is equally aimed at determining the dependency or otherwise of the effect of flow rate and bed height on the fixed bed adsorption of methylene blue dye onto Sphagnum cymbifolium (moss).

Methods: The biomass was characterized by scanning electron microscopy (SEM) for the determination of the morphology of the biomass. The screened biomass samples were characterized at 1000X magnification, 500X magnification and 250X magnification respectively for their surface morphologies. This was done using a scanning electron microscope (FEI-inspect/OXFORD INSTRUMENTS-X-MAX), which was equipped with an energy dispersive x-ray (EDAX) spectrophotometer employed for the elemental composition analyses. It was equally characterized with Fourier transformed infrared spectroscopy (FTIR) before and after adsorption to ascertain the functional groups responsible for the adsorption. This was done using a Fourier Transformed Infrared (FTIR) spectrophotometer (Perkin Elmer, England) in the wavelength range of 350-4000nm.

Keywords: *bio-sorption, sphagnum cymbifolium, sem, fixed bed.*

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Strictly as per the compliance and regulations of:

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Results: Results for the biomass morphology through the scanning electron microscopy (SEM) showed the presence of some pores. These pores represent sites where dye molecules could be trapped in the course of adsorption. The results from the Fourier Transformed Infrared Spectroscopy (FTIR) before adsorption revealed the presence of five functional groups. The functional groups include O-H or N-H, C-H, C≡N or C≡C, C=O, or C=C and benzene. However, after the adsorption, it was found that the functional groups that were responsible include C-H, C≡H and C≡C. Within the level of experimental consideration, it was found that the rate of adsorption was dependent on flow rate and bed height. An increase in flow rate and bed height led to a corresponding increase in the value of q_e.

Conclusion: From the results obtained, it is seen that methylene blue dye can absorb on to *Sphagnum cymbifolium* (moss) through the fixed bed process. Also, within the limit of experimental consideration, that the adsorption of methylene blue dye onto *Sphagnum cymbifolium* (moss) through the fixed bed technique is flow rate and bed height dependent. In each of the analyses, three different experiments were performed and the mean values reported with their standard deviations.

Keywords: bio-sorption, sphagnum cymbifolium, sem, fixed bed.

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I. Introduction

Many industries such as plastic, dyestuffs, textiles and inks, use dyes to color their products, and also consume substantial volumes of water. Due to their good solubility, synthetic dyes are common water pollutants. The presence of very small amounts of dyes from waste waters before it is discharged into the environment. Adsorption techniques are proved to be an effective and attractive process for the removal of non-biodegradable pollutants (including dyes) from waste waters [1]. Most commercial systems use water because it has excellent adsorption ability. But, its widespread use is limited due to high running cost. Due to that, many low cost adsorbents, and waste materials from industry and agriculture have been proposed by several workers []. These materials do not require any expensive additional pre-treatment step and could be used as adsorbents for the removal of dyes from solution.

Some researchers reported the use of plant leaf biomass to adsorb heavy metals from solutions [2]. Resh water algae *Pithophore sp*; was studied by Kumar in finding out its bio-sorption properties on to malachite green (a cationic azo dye) [3]. This work is carried out with the view of expanding the field of application of natural biomass for the treatment of dye waste water through the fixed of application of natural biomass for the treatment for the treatment of dye waste water through the fixed bed technique. Also, it is aimed at determining the impact of flow rate and bed height on the fixed bed adsorption of methylene blue dye on to *Sphagnum cymbifolium* (moss). Since such as in-depth consideration has not been done on this biomass, the information obtained will add to the expansion of knowledge in this area.

II. Materials and Methods

The methylene blue dye, calcium chloride, distilled water and other necessary reagents used in this work were obtained from qualikem laboratory, owerri, Nigeria. The *Sphagnum cymbifolium* (moss) used was obtained from Ikorodu area in Lagos, Nigeria which is located within the following co-ordinates 6.6194°N and 3.5105°E. This sample was identified at the department of Crop science at the Federal university of technology,

Owerri, Nigeria with the voucher specimen number of FUT/CR/005/17. The biomass was washed severally with distilled water to remove any dirt from it. The washed biomass was air dried for ten days until a constant weight was obtained. The biomass was grinded with a new sonic domestic blender to avoid any form of contamination. It was further screened using 600-800 micron sized sieves and stored in air tight containers ready for adsorption.

This methods and techniques employed in these analyses are the standard methods which have been used by other researchers [4].

III. Characterization of The Bio-Sorbent

The surface structure and morphology of the *Sphagnum cymbifolium* (moss) was characterized at 1000X magnification, 500X magnification, and 250X magnification, respectively. This was done using scanning electron microscopy (SEM) (FEI-Inspect oxford instrument-x-max), which was equipped with an energy dispersive x-ray (EDAX) spectrophotometer employed for elemental composition analysis.

The biomass sample was further characterized for their fundamental functional groups before and after adsorption experiment using Fourier Transformed Infrared (FTIR) spectrophotometer (Perkin-Elmer, England) in the wavelength range of 350-4000nm using KBr powder and fluka library for data interpretation.

a) *The Fixed Bed Set Up*

The fixed bed was set up by packing wire gauze, glass wool, glass beads, glass wool, biomass and glass wool in that order in a graduated condenser. Then a dye solution of a known concentration and pH pressurized from down to top where a known amount of the bio-sorbent is placed with a peristaltic pump (CHEM-TECH model X030-XB-AAAA365, China). Subsequently, a sample was collected for u.v analysis in a u.v spectrophotometer (CAMPEC M 106 Model, England) by monitoring the absorbance already determined for methylene blue dye at 600nm. The variables investigated include the effect of flow rate and bed height.

b) *Effect of Flow Rate on Adsorption*

Experiments were performed at different flow rates of 2nm^3/s, 30m^3/s and 40m^3/s respectively, while keeping constant a bed height of 1x10^{-2}m, 40mg biomass dose, 90mg/L and a pH of 4. The dye solution was subjected to pass through the column already prepared using the peristaltic pump. The samples collected were subjected to u.v analysis for absorbance values were converted to concentration by the use of Beer Lambert law. Similar experiments were carried out in triplicates and the mean values and standard deviation reported.

c) *Effect of Bed Height on Adsorption*

Experiments were conducted at different bed height of 4x10^{-2}m, 5x10^{-2}m and 6x10^{-2}m while keeping constant a flow rate 10m^3/s. 90mg/L dye solution, pH of 4 which is the pH of maximum adsorption for methylene blue dye. The dye solution was subjected to pass through the column already prepared using the peristaltic pump. The samples collected were subjected to u.v analysis for absorbance measurements at 600nm. Subsequently, the absorbance values were converted to concentration by the use of Beer Lambert's law. Similar experiments were carried out in triplicates and mean values and standard deviations reported.

NOTE: The amount of dye adsorbed per gram biomass (q_e) was calculated using the equation below

$q_e = V (C_O - C_e) / M$

Where V= volume of samples in dm^3

C_o= Initial dye concentration in mg/L

C_e= Equilibrium dye concentration in mg/L

M= Mass of the biomass in g.

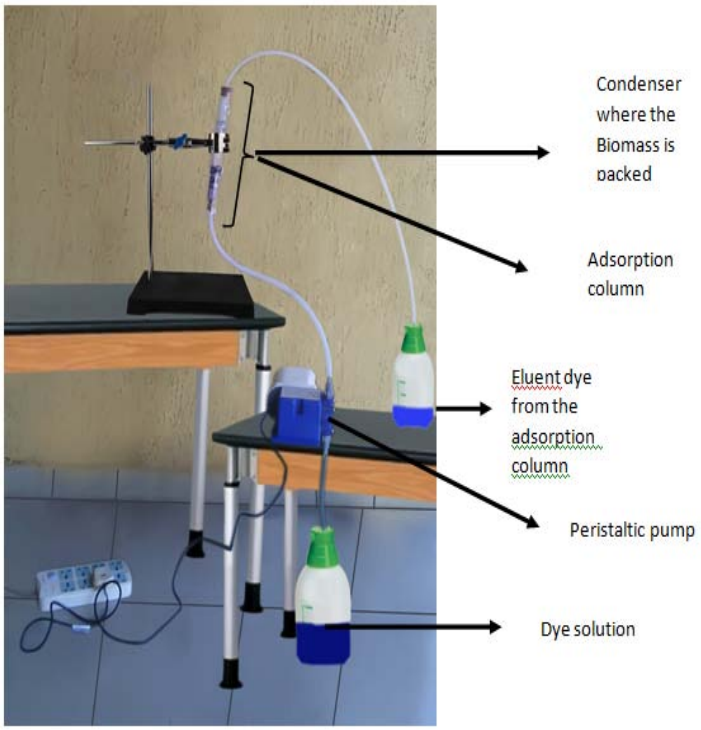

Fig. 1: Fixed bed technique apparatus

IV. Results and Discussion

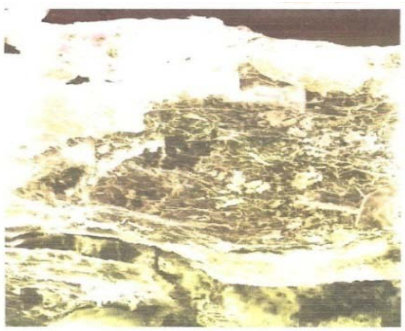

Fig. 2: SEM morphology of *Sphagnum cymbifolium* (moss) (X250)

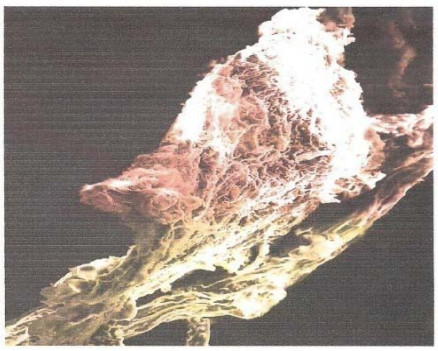

Fig. 3: SEM morphology of *Sphagnum cymbifolium* (moss) (X500)

Fig. 4: SEM morphology of *Sphagnum cymbifolium* (moss) (X1000)

The SEM micrographs of *Sphagnum cymbifolium* (moss) showed the presence of unevenly dispersed cavities on the surface of the biomass. These cavities provide sites where the molecules of the dye could be trapped in the course of the adsorption. The SEM micrographs of (X250), (X500) and (X1000) magnifications are shown in fig.2, 3 and 4 respectively.

Similar cavities have been discovered by other researchers [5].

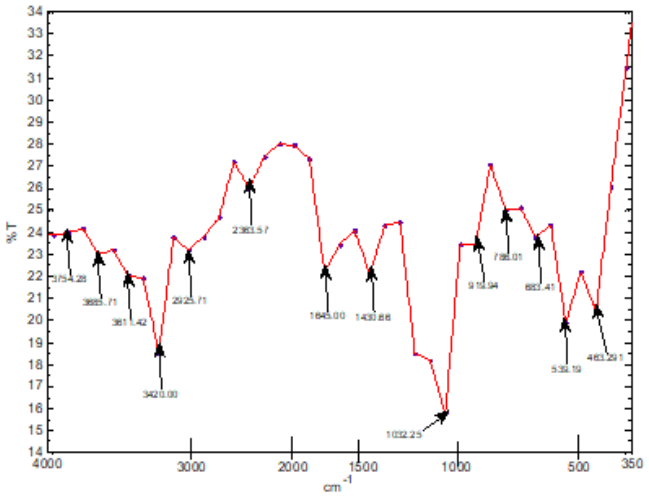

Fig. 5: FTIR Spectrum of *Sphagnum cymbifolium* (moss) before adsorption

The FTIR spectrum of *Sphagnum cymbifolium* (moss) before adsorption shown in fig.4 revealed the presence of five major functional groups. The functional groups include O-H or N-H at 3420nm. C-H at 2925.74nm, C≡N, C≡C at 2363.57nm, C=O, C=C at 1645nm and benzene at <1000nm.

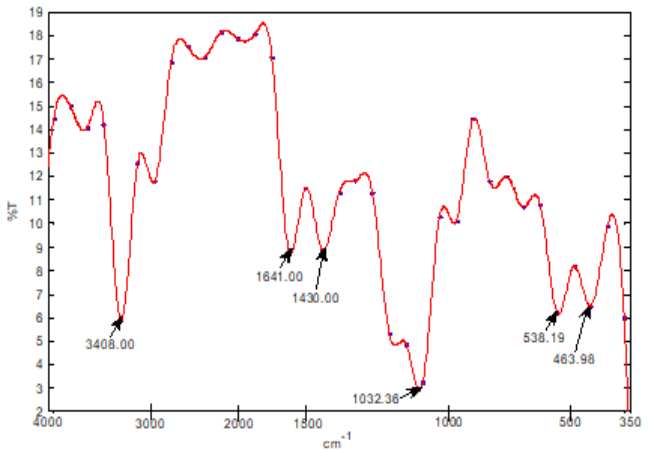

Fig. 6: FTIR Spectrum of *Sphagnum cymbifolium* (moss) after adsorption

The FTIR Spectrum of *Sphagnum cymbifolium* (moss)) after adsorption as shown in fig.6 above was used to ascertain the functional groups that were responsible for the adsorption. After the adsorption, there were some bond displacement of the original peaks indicating the functional groups that were responsible for the adsorption reaction. The displacements occurred at 2925.71nm and 2363.51nm which corresponds to C-H, C≡N and C≡C functional groups. Although, the intensity of the peaks greatly decreased after the adsorption, the functional groups on the biomass did not disappear totally during the biomass characterization after the adsorption.

This indicates that the interaction of the dye molecule with the *Sphagnum cymbifolium* (moss) was merely a physical process. A similar occurrence was reported in the characterization of *Cedrus libani* (Elizabeth leaf) by Idika *etal* (2020) after adsorption.

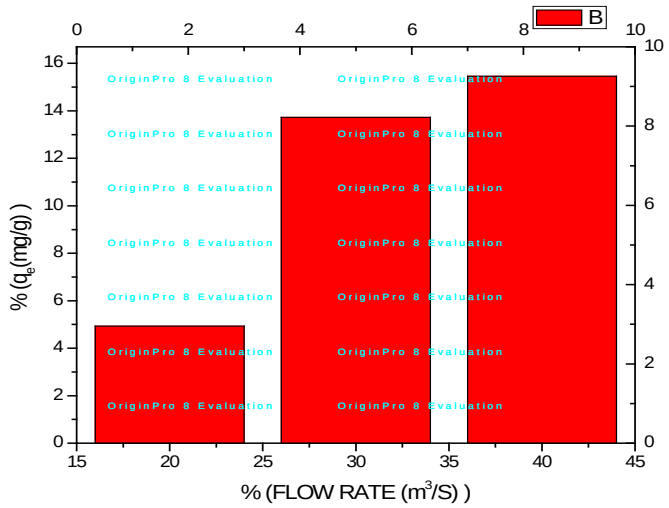

Fig. 7: Effect of flow rate on the fixed bed adsorption of methylene blue dye on to *Sphagnum cymbifolium* (moss)

As could be seen from fig.7, an increase in flow rate caused a corresponding increase in the q_e values within the range of experimental consideration. A similar effect was reported by other researchers [6]. This could be due to increase in the force of attraction between the dye solution and the biomass surface area.

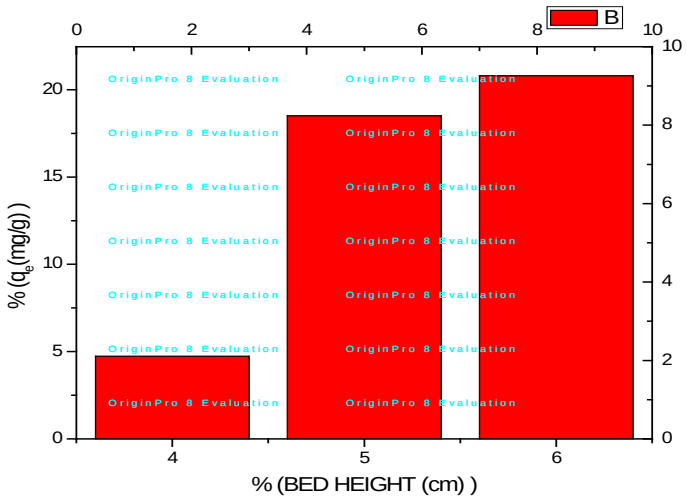

Fig. 8: Effect of bed height on the fixed bed adsorption of methylene blue dye on to *Sphagnum cymbifolium* (moss)

Figure 8 shows the effect of bed height on the quantity of the methylene blue dye adsorbed onto the biomass (q_e). The q_e values for the biomass increased with a corresponding increase in the bed height within the range of experimental consideration. The result indicates that, the longer the bed height, the higher the q_e values. A similar situation has been reported in similar investigations [7]. This could be attributed to the longer time of interactions between the biomass and the dye solution.

V. Conclusion

The findings of this research vividly reveal that methylene blue dye can be adsorbed on to *Sphagnum cymbifolium* (moss) biomass through the fixed bed process. Additionally, the two variables, flow rate and bed height can impact the adsorption properties of methylene blue dye on to *Sphagnum cymbifolium* (moss).

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16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.

- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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