



Our local action is a “Marin Biomass Study.” This is a deep dive and a plan to advance an emerging biomass recovery system in Marin. This system has considerable potential to mitigate climate change or even reverse some of its effects. The study is intended to help achieve that potential.


Marin Biomass Study Group




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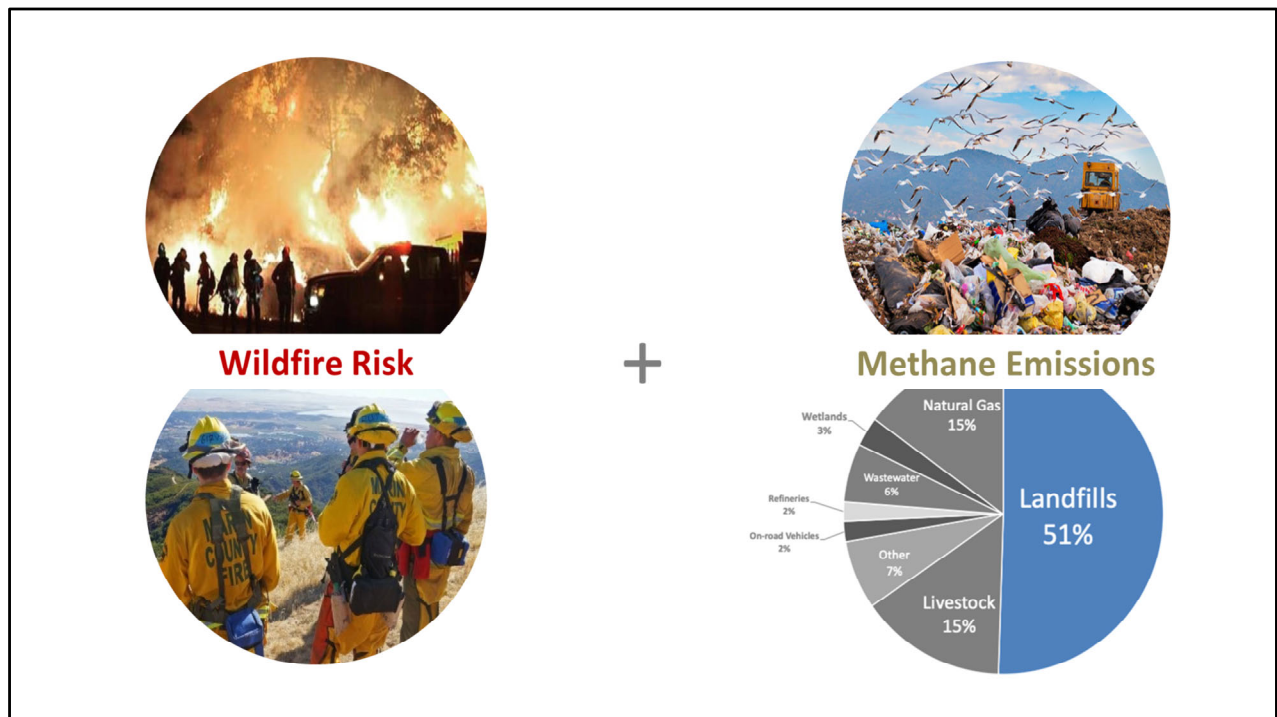


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Drawdown Marin
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A group of concerned citizens with different expertise – fire prevention professionals, land managers, scientists, and environmental leaders – have come together to work on this emerging system. We call ourselves the Marin Biomass Study Group. We have been reaching out to key local collaborators and collecting information about existing practices in the County. This is the first part of a more detailed study as well as part of our funding strategy.



Our study is motivated by two climate-related stimuli: increasing environmental risks due to wildfire, and recognition that biomass in landfills produces large amounts of methane emissions. (Over half of the Bay Area's anthropogenic methane emissions are from landfill leaking.)



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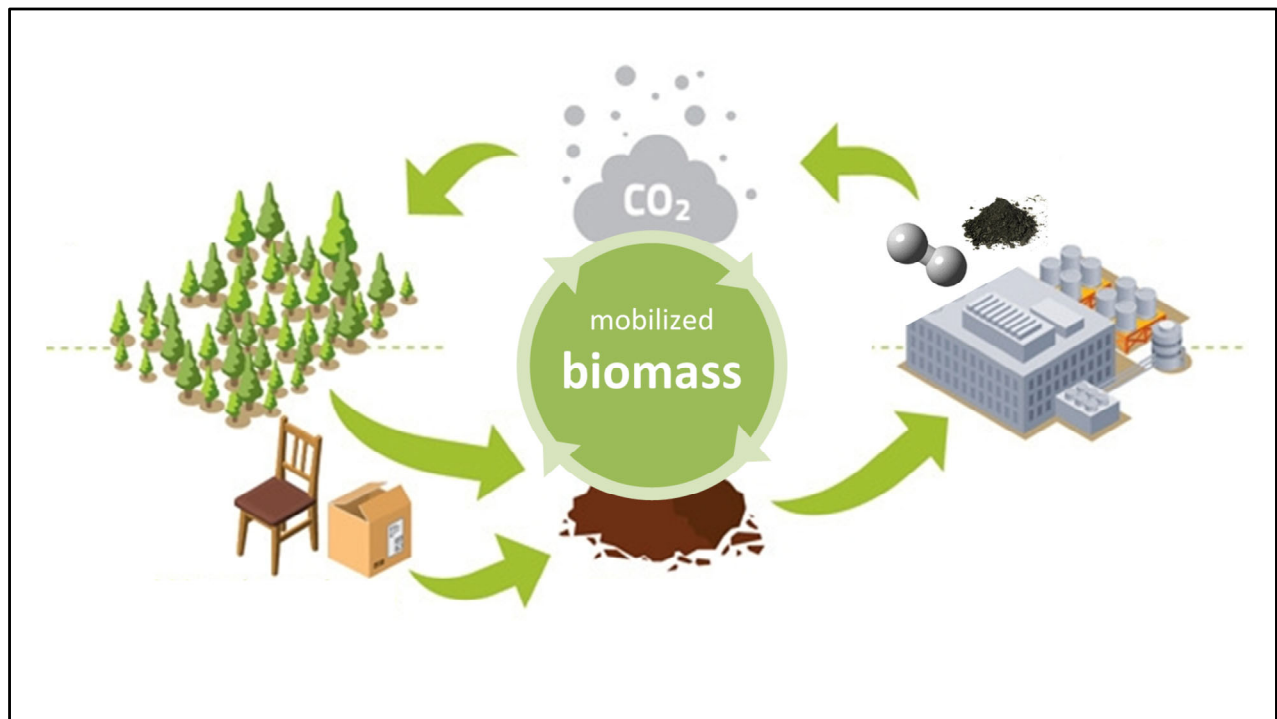
Thin risky biomass

Divert organic materials

There are two emerging solutions for these problems -- (1) new land and vegetation management systems that will thin risky biomass, and (2) new scrap material programs that will divert biomass from landfills.

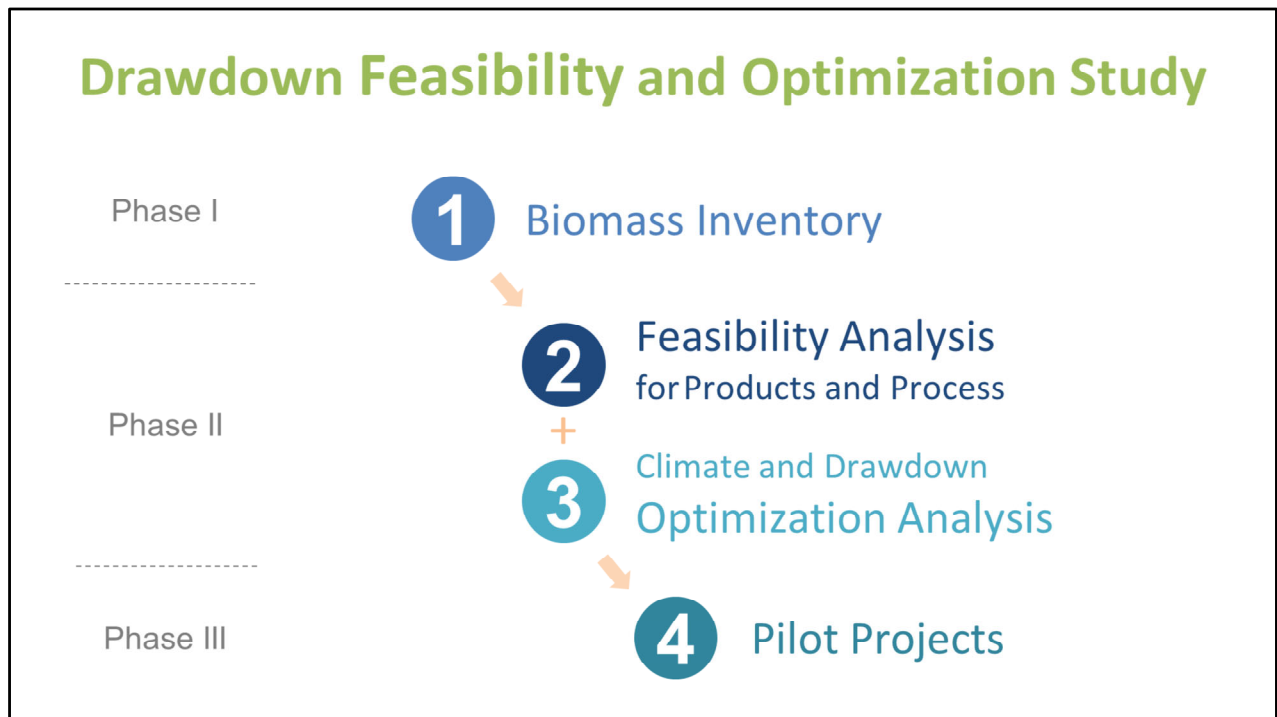


- The concern is – a lot of biomass is being generated:
 - Food, food scraps, and compostable packaging from commercial and residential sector.
 - Debris from the construction and demolition activity.
 - Landscape trimmings that need to be shunted into some kind of recovery process.
 - Biomass thinning to improve fire safety and reduce wildfire risk.



That's the concern motivating our study. Where will they go? Our objective is to inform and pilot practices based on sound ecological principles. We are thinking in terms of a biocycle that can recover biomass and maximizes reductions of greenhouse gases.

Drawdown Feasibility and Optimization Study

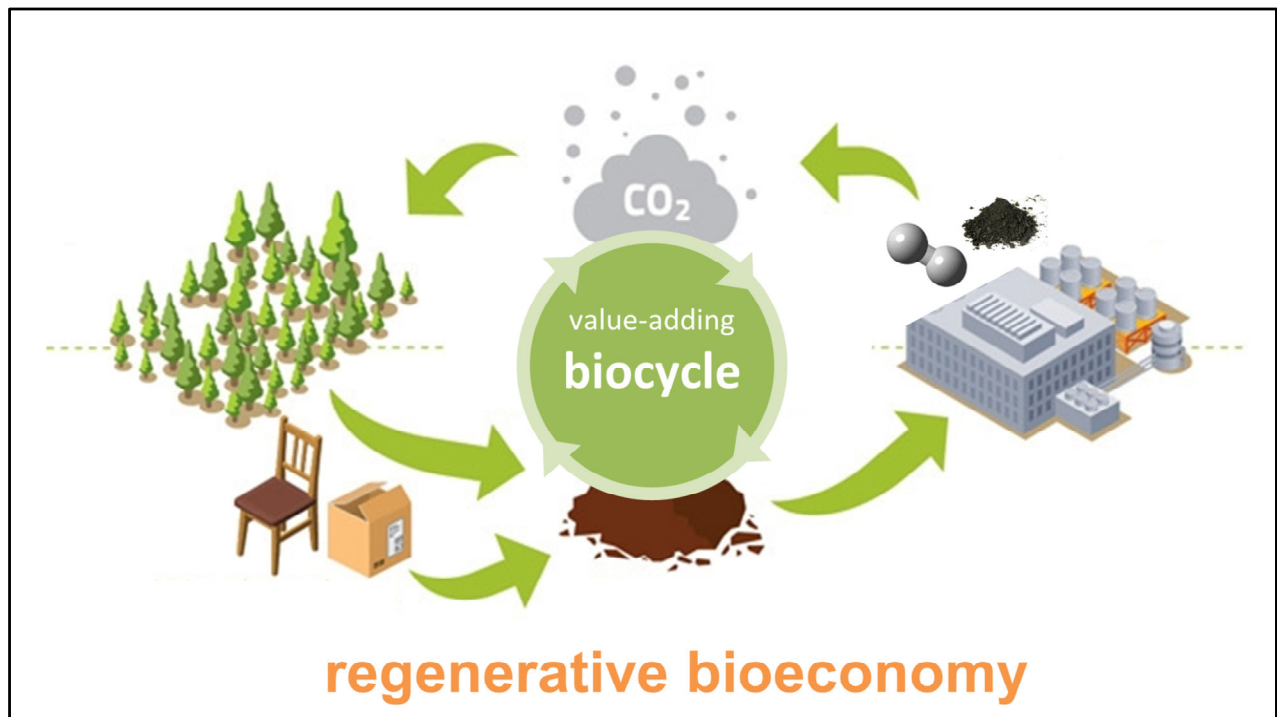


The team has envisioned a four-part study, which we expect to undertake in three phases. We have already begun the first part: inventorying new biomass materials being mobilized for recovery in Marin. This information will feed into a recovery option feasibility analysis and a greenhouse gas reduction optimization analysis. Findings from those will guide pilot projects on infrastructure and practices.

QUESTION: what needs to be studied?

ANSWERS:

- The amount of biomass being mobilized
- The products and process that are most feasible for Marin to pursue
- The climate and drawdown impacts of them and a strategy that optimizes them



Our study is exploring several things. One is to look at the overall biomass recovery system as a biocycle that serves Marin. That means studying and strategizing its development to assure that it can produce good, long-term value. It also means preventing development based on a series of short-term, least-cost choices. This is the difference between building another “waste” economy instead of a regenerative bioeconomy.

bio-economy

n. use of renewable, biological resources to create value-added products, such as food, feed, bio-based products and bioenergy.

We use the term “bio-economy” to mean an economy that relies more deeply on short-cycle or “renewable” biological resources and ecosystem services. A bioeconomy makes products that derive from a biocycle and return to a biocycle.

regenerative economy

n. an economic system that regenerates its assets; a self-feeding, self-renewing system

A regenerative economy is a circular economy that more justly produces and reproduces goods and services that go beyond sustaining to rebuilding human and environmental resources. Again, this includes mechanisms that recovery and recycle – two aspects of a circular economy like the Earth’s carbon cycle or a regional biocycle.

Sectors and industries in a regenerative economy have strong innovation potential due to their use of a wide range of sciences, enabling and industrial technologies, along with local and tacit knowledge. It is an inclusive and adaptive system.

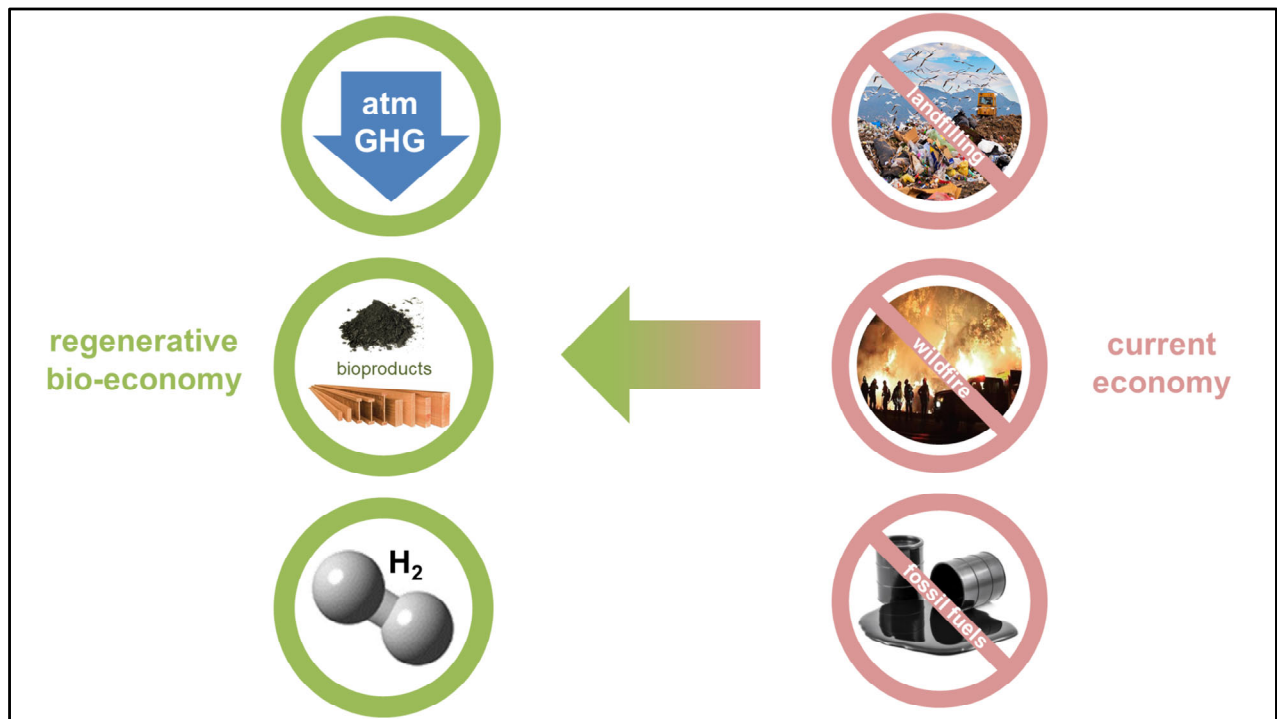
Of note, the goal of a regenerative bioeconomy is included in Marin’s new Climate Action Plan.

A key part of a regenerative economy today is stabilizing or reversing climate change. We have seen in the last few months and, frankly, the last couple of years what non-regenerative management has done to forested lands: it has left them vulnerable to catastrophic wildfire. Climate change is exacerbating

this problem by changing precipitation patterns that trigger extended drought, extend wildfire season, and reduce forest health.

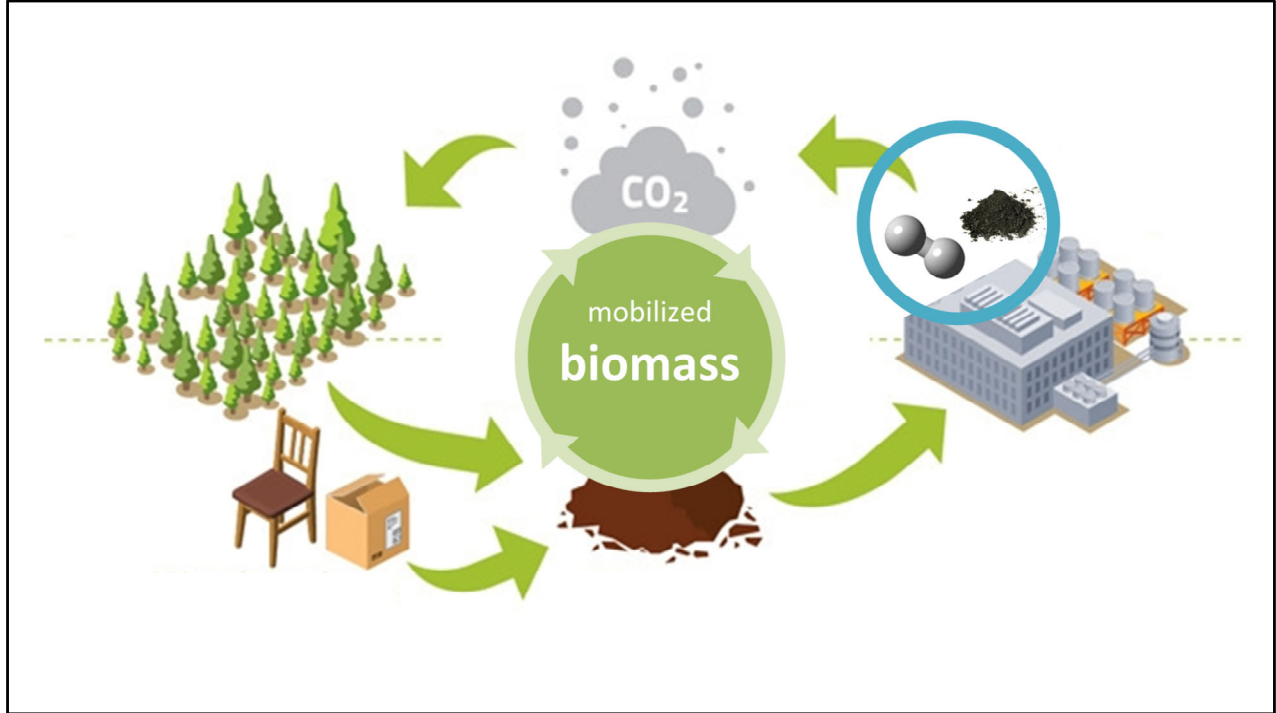
It also means knowing and acting with our GHG footprints in mind. One estimate suggests that $\frac{3}{4}$ of Marin's carbon emissions are being released outside of the county. That means that the carbon footprint of Marin's consumption – i.e., the production emissions embodied in the products we buy – are 3x the emissions inside the county. That means that Marin is effectively exporting its GHGs, not living a low-carbon lifestyle. So, we all need to think about how to reduce the carbon footprint of products and services we use and do more environmental/social good with our buying and selling.

We need an economy that goes beyond limiting greenhouse gas emissions; we need one that reverses the past two centuries of fire suppression and climate pollution by improving land management and drawing down carbon from the atmosphere.



So, this is a project that looks at ways to build an economy with potential to remove or “draw down” GHGs out of the atmosphere. More proximately, it is about preventing wildfire damage, producing a resource recovery economy instead of a landfilling economy, and displacing fossil fuels in favor of lower-carbon, next-generation energy sources.

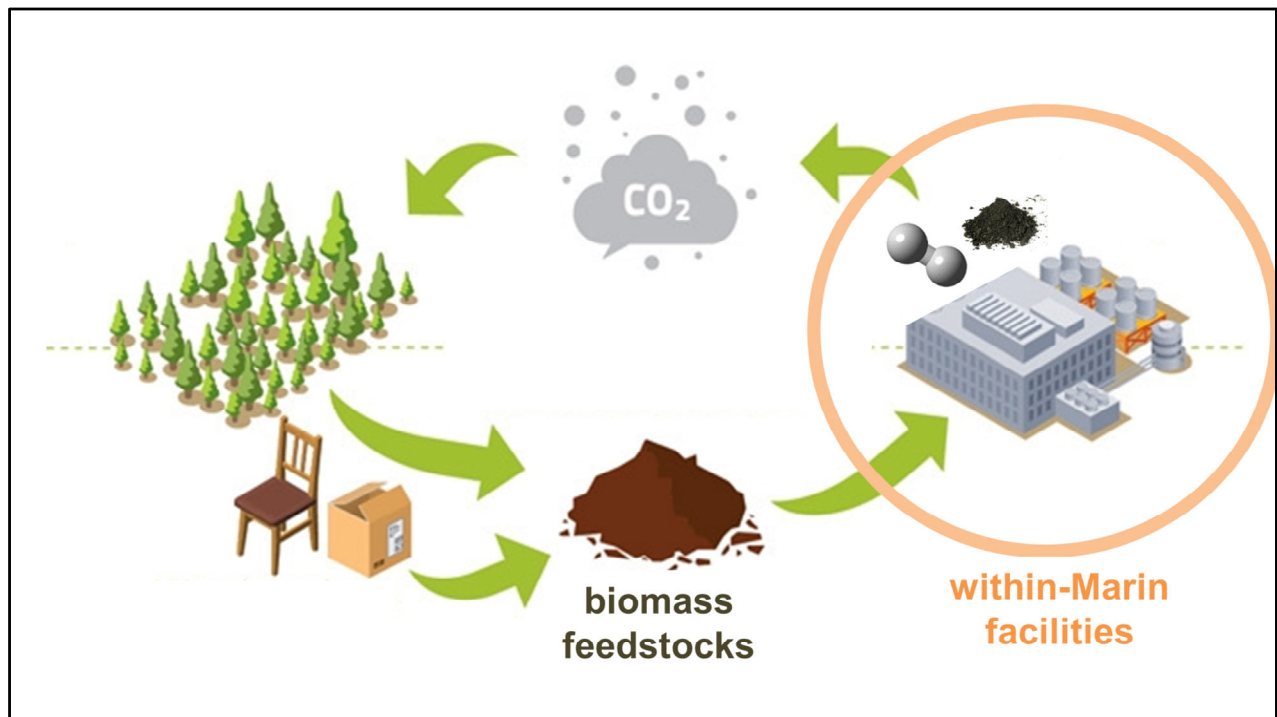
This project is about building a system that gets organic materials out of the landfill stream, where they produce methane – a potent greenhouse gas.



This project is about the possibility of turning biomass, including trimmings from wildfire prevention work, into hydrogen that powers the next generation of ferries on the Bay.

This project is about bringing the people of Marin into support of new biomass-to-product and biomass-to-energy facilities within the county, rather than exporting it elsewhere.

In sum, the solution is a roadmap toward a more regenerative bio-economy for Marin. At a minimum: insights that can help roadmap one part of a more regenerative bio-economy for Marin.



At a minimum, this means supporting the development of facilities within Marin that can absorb the new streams of mobilized biomass, turn it into useful products, and make it available for within-county uses – ideally at prices that makes this pay for itself.



Measure C (2020)

One part is Measure C. This measure passed earlier this year and did two key things. It instituted a parcel (property) tax of \$75 per year that raises \$19M annually for fire prevention activities. It also created the Marin Wildfire Prevention Authority, who will oversee these funds. Part of what they will pay for is work on open space lands and around the built environment to reduce fire risk.

- Public land management is another part. Organizations with significant land holdings, such as the Marin Water District, are looking into ways to decrease fire risk on their lands too.
- The net result is new flow of materials to manage and opportunities for the public to learn about the connections between wildfire, climate change, and resource flows. Among the lessons to learn is how much material we are talking about. That's not clear. Is it big? Probably not. Is it small? We are not sure yet. Where is it going to go? That is key big question.



One is SB 1383. This is a law passed in 2016 to cut Statewide short-lived climate pollutant emissions by almost half. One of these is methane, and one of the greatest sources of methane is landfill. Half of the Bay Area's methane emissions come from landfills, and more or less all of that is from burying biomass in there. No matter what anyone tells you, producing methane in landfills is a bad idea. They are inefficient environments for producing methane, and they leak out methane – much more than we previously thought. So, bottom line, we need to get organics out of landfill, and SB 1383 requires that. In fact, it obliges the State to divert 75% of organics from landfill in the next five years. Urban areas like Marin will need to strive for nearly complete diversion. That means that

Here are a few key things about how SB 1383 works:

- The cities of Marin and the unincorporated County will be rolling out infrastructure to separate organic materials from the landfill stream. In the near future, more or less every residence and every business will have a green bin for food scraps, easily biodegradable packaging,

and landscape trimmings. Quite likely, these will be handled by the same company that picks up recycling at the curb or that hauls non-recyclables to landfill.

- The fate of these materials is, as yet, unknown. They have to be put through a “biomass conversion” process. The emerging regulations declare composting and anaerobic digestion to be options. Beyond that, everything else requires a special equivalency demonstration.



Composting of organics diverted from landfills solves the problem of emission of methane from landfill. Composting is a biological process that produces carbon dioxide. However, this biogenic carbon dioxide has the potential to be a short-cycle GHG that does not contribute to net global warming. How? By assuring that it is connected with GHG uptake. For example, compost, as a carbon-rich soil amendment, embodies the bioenergy resources of recoverable organics, rendering that energy potentially available for soil ecosystem processes that in turn can support increased soil water holding capacity and enhanced plant growth, i.e., enhanced photosynthetic capture of CO₂ from the atmosphere. (While some trace emissions of methane and nitrous oxide can occur from active composting, these quantities are small and more than offset by the GHG benefits of the process and those associated with use of the finished compost.)



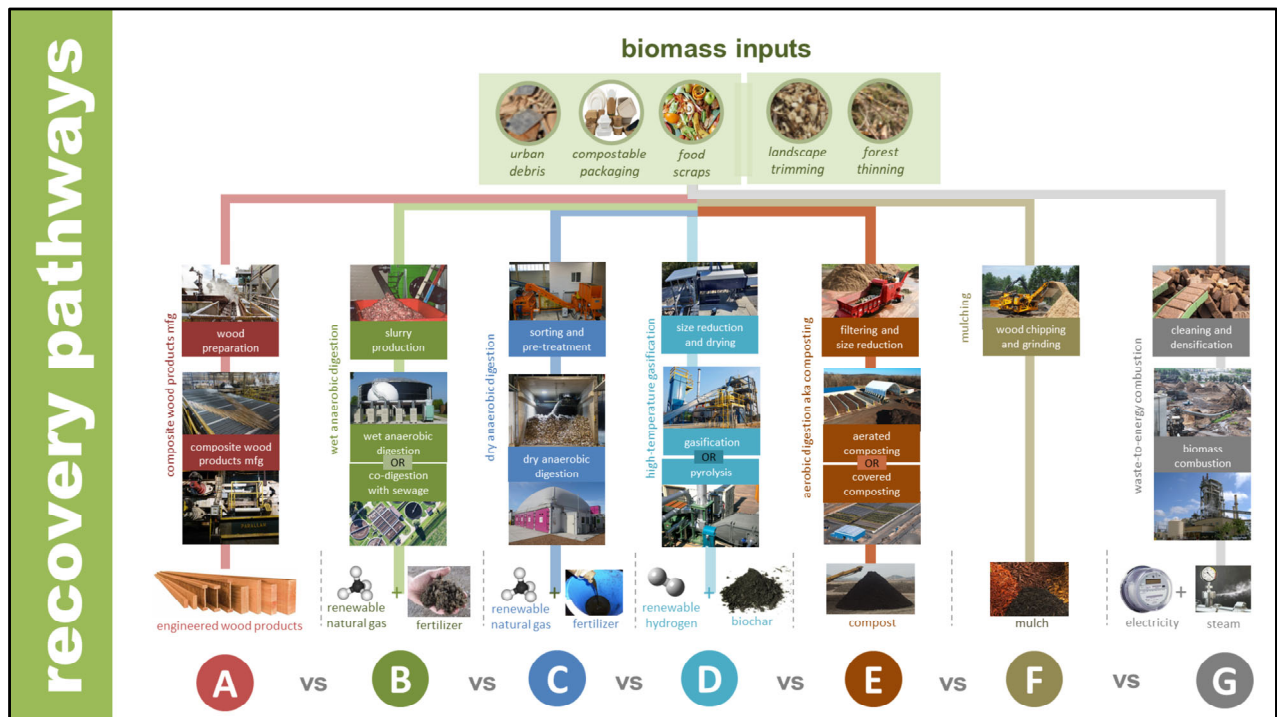
Anaerobic digestion – a process used to biodegrade sewage, manure, food waste and other organics – is another option. It uses an enclosed reactor to break down biomass without oxygen. This process produces two products: (1) biomethane (aka renewable natural gas) which can be captured and used directly as a fuel, or to generate electricity and (2) digestate, a solid organic residue relatively high in plant nutrients that can be stabilized through composting or directly land applied under appropriate conditions.

Thus, both composting and anaerobic digestion both offer significant drawdown potential.



But they are not the only approaches for recovering biomass that produce different products. Part of our study is starting at the end and work forward.

For example, it is possible to turn biomass into (1) green hydrogen, which can be used as a fuel, and (2) biochar (aka carbon black), a material with a wide range of high-tech and low-tech applications – from use in ultracapacitors or firm rubber products like tires and floor mats.



The point is that, pursued thoughtfully and structured intelligently, the emerging biomass recovery pathways can be part of a broader circular and regenerative bio-economy. However, if everyone looks for the least-cost solution to the new recovery mandate or rushes to put wood somewhere other than forests, we will miss the potential of this process and might end up with rebound effects. Different biomass types lend themselves to different approaches to management for climate and other environmental benefits.

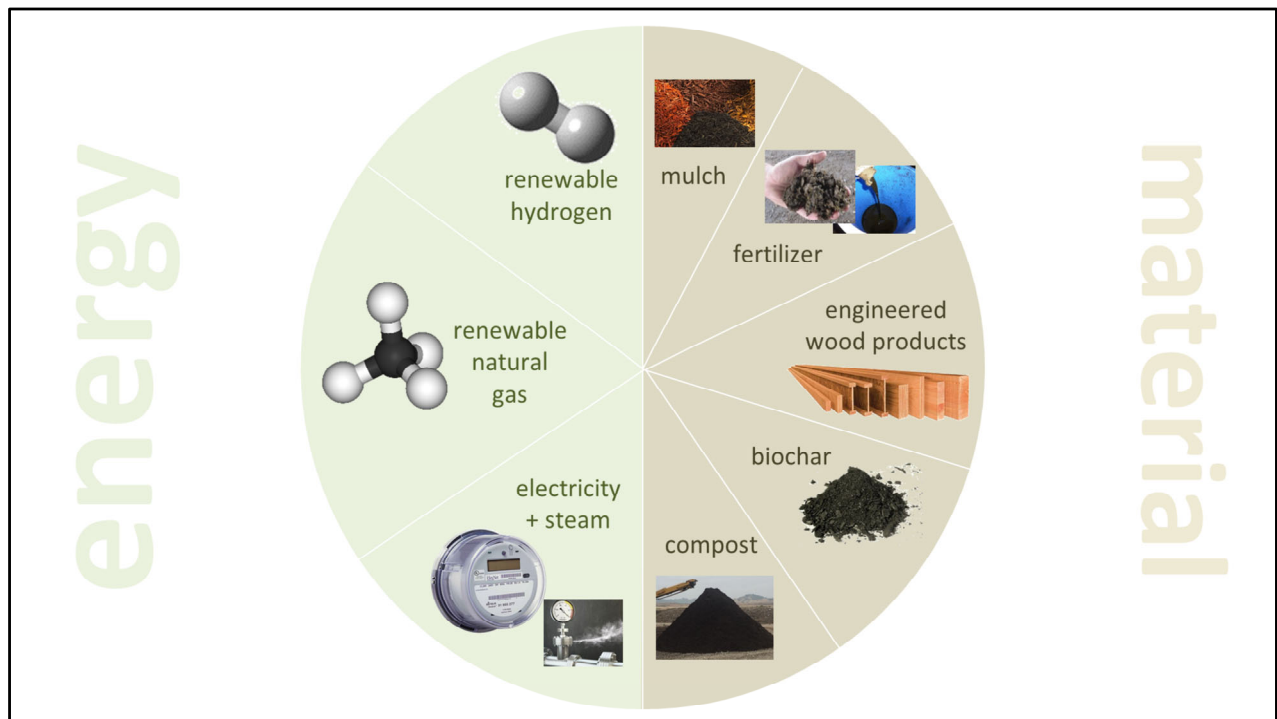
Transportation impacts are another concern. The location of these services affects their carbon reduction potential. Presently, waste wood in Marin gets hauled to a biomass energy plant east of Stockton – where it is burned. That hauling generates a lot of carbon pollution and is expensive. This transportation and burning exports Marin’s carbon emissions. One of the keys is figuring out how to build this kind of infrastructure in Marin without compromising environmental quality. That is possible, if we get behind it, and represents an opportunity to strengthen our local economy by taking responsibility for our own “waste” resources, creating jobs and generating

local, renewable energy while helping to address the climate crisis.

For example, creating a biomass sort yard that reuses and recycles biomass would create new jobs. So would an educational system that helps people learn how to handle and sort materials to assure high-value recovery and bioproduct manufacturing. Processing of biomass and reuse in County can renew soils and lands.

Revenue from a parcel tax will be raised to increase fire prevention efforts and to decrease wildfire-related property damage in the County. That is a good thing. But if we are going to cut and mobilize a lot of biomass in the county, are we going to manage it as a “waste” or as a “resource.” It seems like it would make more sense to build a system that delivers low-carbon, renewable, long-term benefit – while also providing the “ecological service” of reducing climate change.

Your trash rates are going to go up, unless we build a system that enables them to go down. (I would like to call these your “material recovery rates,” but that language is not yet widespread.) This new system will prevent most organic materials from going to a landfill. You will see this because you will see new trash (er, resource recovery) infrastructure emerging over the next couple of years. It will standardize the colors of bins used for collecting materials sent to landfill (grey/black), recycling (blue), organics (green), and separated food (brown) statewide. Going to San Diego? Same system as Marin. Going to Tahoe? Same as Marin.



Marin is going to produce bioresources, but you might not benefit from them. One of the provisions of SB 1383 is a requirement to divert organics from landfill. A second provision requires cities and counties to set up procurement programs that buy them back. This means that local governments need to buy mulch, compost, renewable natural gas, and figure out how to use them. One way that they can comply is by using them publicly. Another way is by creating markets that enable residents to buy them. Some pressing questions are, what do the people of Marin want? How can we give them high-quality products? How can we prevent Marin from having to buy low-quality compost that contains microplastics and, for lack of anything better to do, spreading them in parks, in landscaping, and on playgrounds? I think we don't want that. But the law is the law.

Our study is designed to help the public sector and private sector align on a long-term, high-value solution. Without a roadmap or plan of that sort, we are going to have a lot of incremental decisions that produce short-term, low-cost solutions and not deliver high-value carbon benefits. It's this latter

part that we are working toward.



Measure C
(\$200M)



Senate Bill 1383
(> \$500M)

A pretty good chunk of money.

Measure C will spend \$200M in the next decade.

SB 1383 will likely require even more to build/operate. It may exceed \$500M.

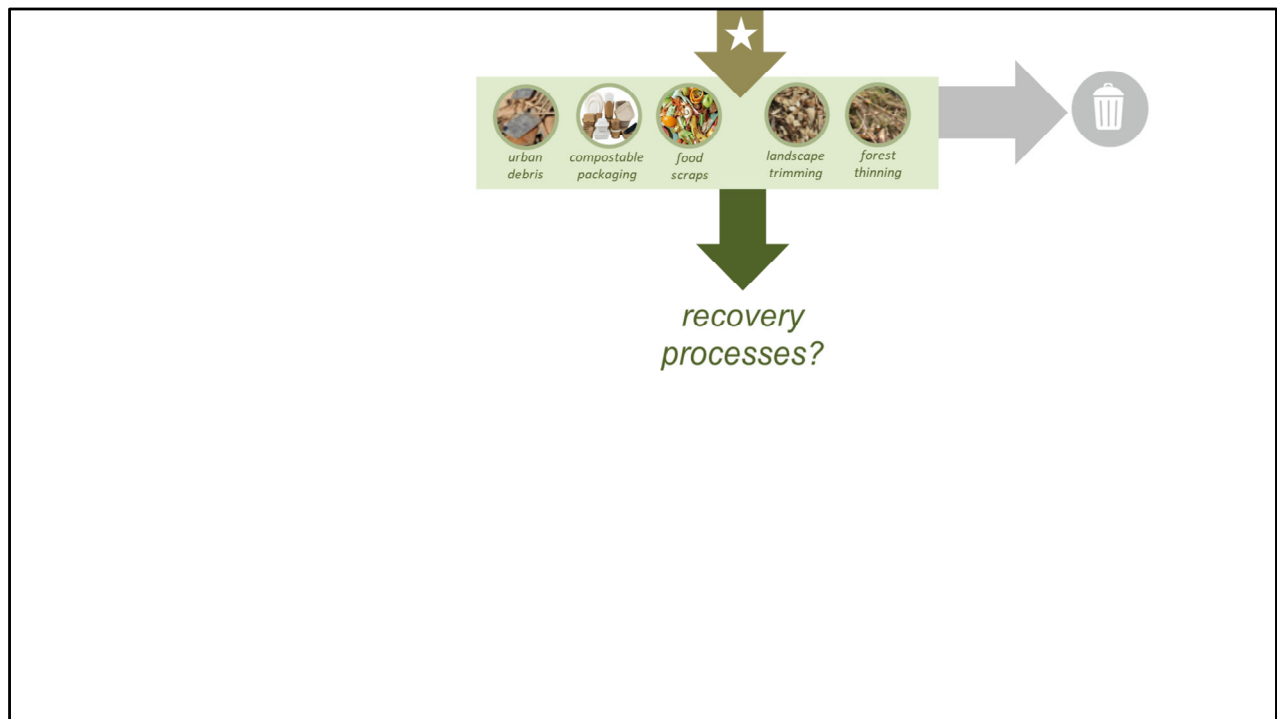
Those monies will be “costs” if they are designed to fit the “waste economy.”

They will also produce rebound effects – potentially cutting into the carbon reduction potential by pulling bio-resources out of Marin and sending them to other parts of the State.

So, this is not really just about the money. It is also about the nutrients and energy resources that Marin has and how they will be used in the County or shipped outside the county.

It is also about Marin’s need and ability to reduce the County’s greenhouse gas emissions. An analysis of the carbon intensity of Bay Area populations showed that Marin County residents have among the highest carbon footprints in the Bay Area, when looked at on a consumption basis.

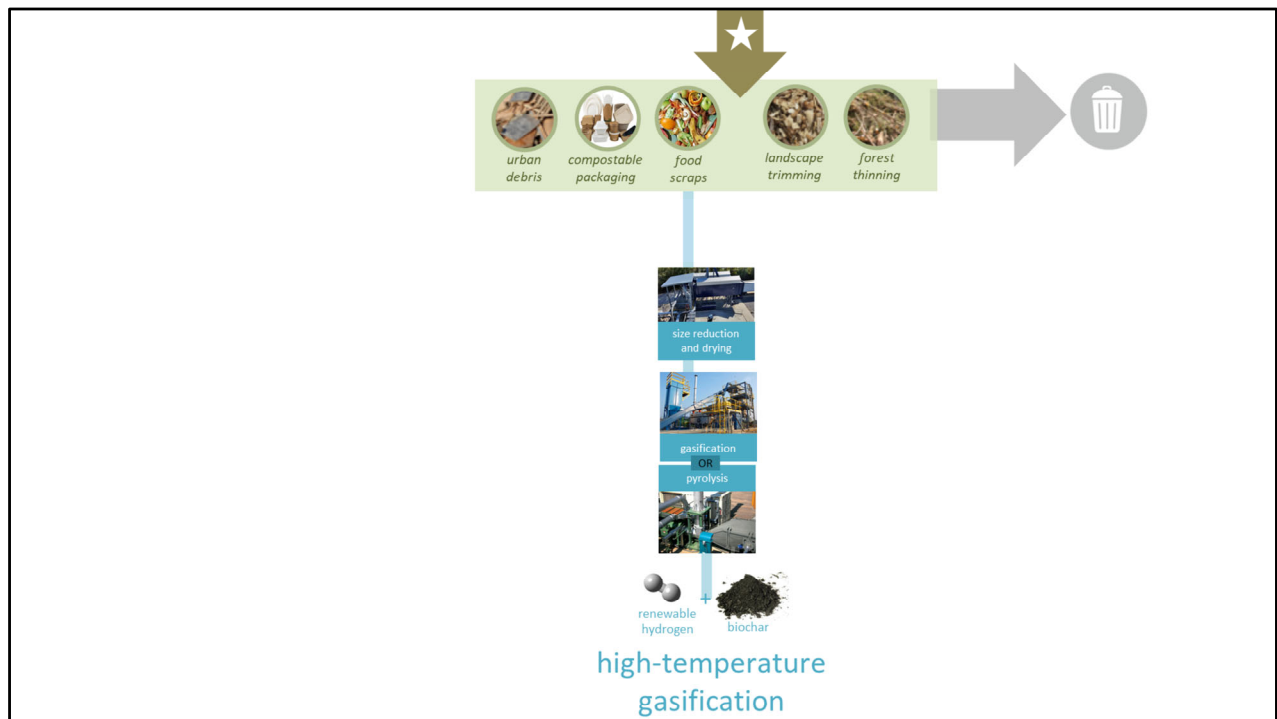
Developing an economy that lowers the carbon intensity of the Marin lifestyle without diminishing quality of life is one way to look at what this project can do.



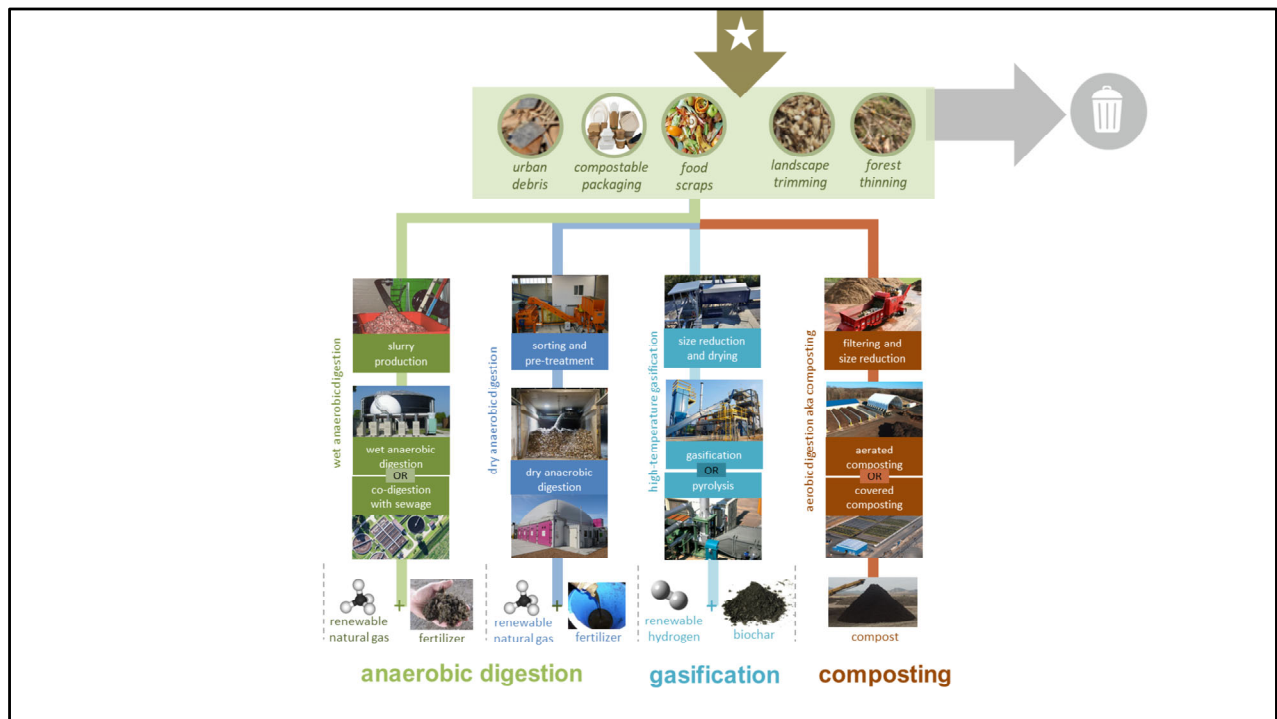
Part of work has been thinking about the emerging systems in terms of the supply chains that can recover biomass.

Let's start with what the average resident in one of the cities of Marin will see [STAR]: you collect organics from your household, and you put them out at the curb for collection. Then a vendor -- say, Marin Sanitary Services in San Rafael -- collects these materials, sorts them, and sends to the next step(s) for recovery.

If the materials are too contaminated, MSS might not have the luxury of sorting them. So, they may have to send them to landfill. If MSS can figure out how to separate them into recovery streams, then question is...what should they do with them?

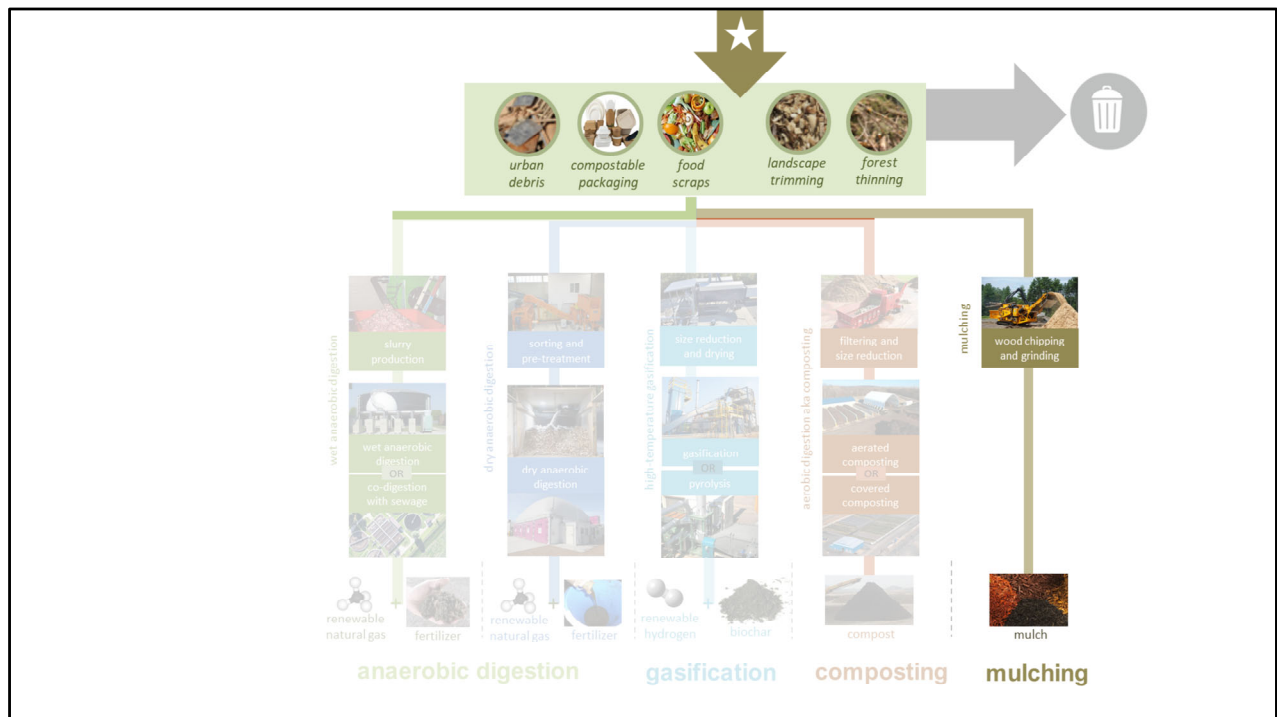


Imagine that MSS is exploring developing a recovery pathway based on gasification. This technology heats up biomass to high temperatures and cracks the bio-chemicals into a hydrogen-rich “syn gas” and a carbon-rich biochar. They could try to build this kind of facility, and then they would have these products to sell

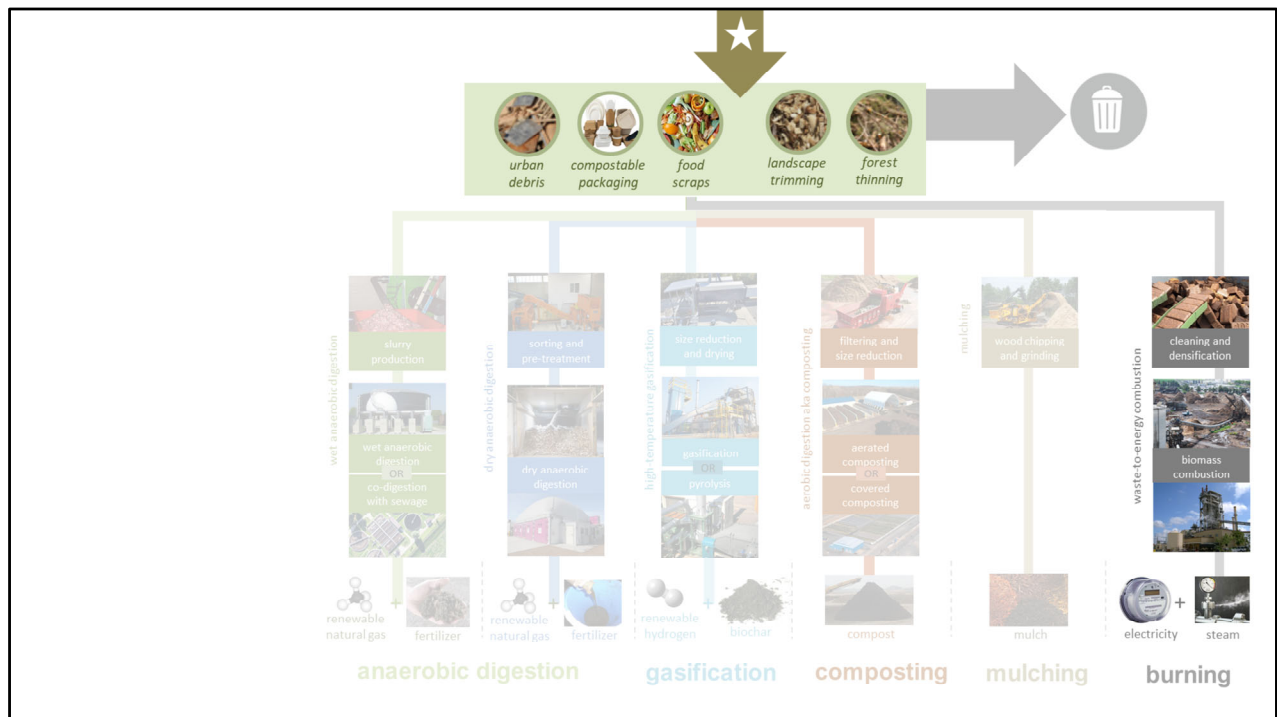


The point is -- there are already choices about where this can go: landfill (if too contaminated), composting, anaerobic digestion, gasification, or some combination of these.

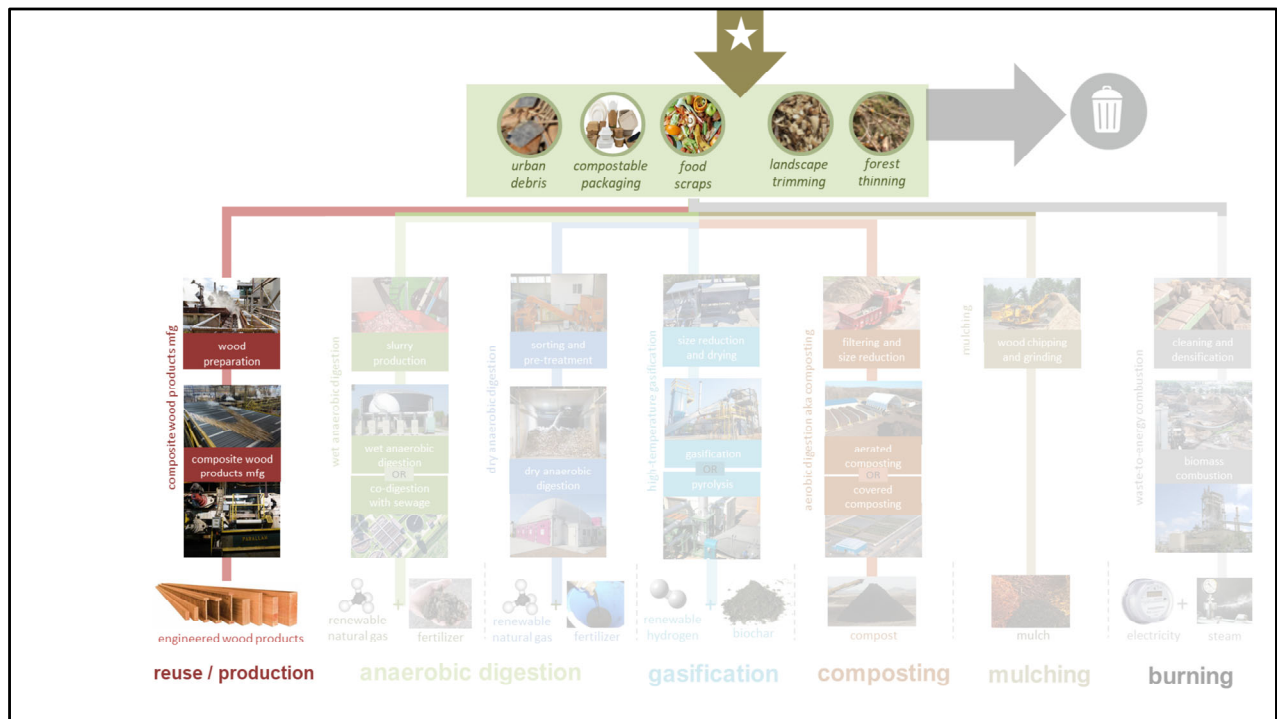
However, this does not define all the possibilities.



Take, for example, the idea of woody biomass. If clean enough, one of the simpler things to do with it is chip it and turn it into mulch. This have variations applications as a landscape cover.

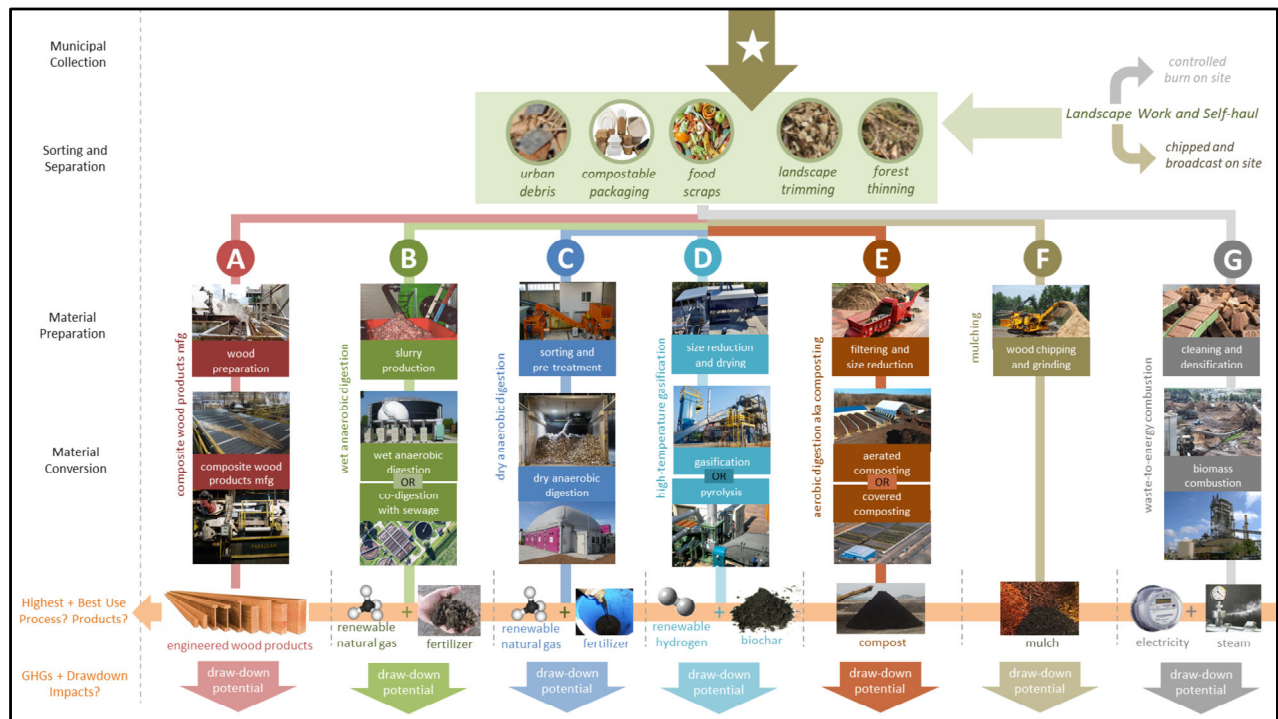


There are also a few places in the State where you can still burn it to generate electricity, but they are slowly shutting down and farther and farther away.



There might be other options that have not been fully considered, such as implementation of deconstruction practices and creation of a sort yards that make lumber available for reuse.

Or the ability to segment wood into streams that can be used for other things, such as digestion and creation of industrial chemicals or recovery of good pieces for production of engineered wood products. Lastly, there is the possibility that the wood could find reuse without any modification, if meaningful building deconstruction practices and recovery yards are created.



So, if we look at these supply chains and how they might intersect, we can see a few things: that there are multiple conversion options, and that upstream choices affect downstream choices.

Further, we can see that these conversion processes create different sets of products and that the nature of the technologies create products of variable qualities and values. These products are of varying values and GHG drawdown potentials.

Key question: which ones are right for Marin? What do the residents of Marin want to see created? What are valuable to buy, and how do we get there?

I hate to say it, but it's complicated. This study is being undertaken to make understandable. It is working to develop leading insights about where we can go, as well as to pilot and help build infrastructure that turns the right options into reality.

Like, working with people to turn the garbage truck fleet in Marin into

zero-emission vehicles.

Or assuring that we have high-quality compost for municipal landscaping.

Or powering ferries that run off hydrogen, rather than diesel.

What We Can Do

- Support the mindset shift away from waste
- Start thinking and talking about regenerative economies

This is more than participating in recycling. It is about looking upstream and downstream at our consumption bundles and taking responsibility to ensure that they are coming from and going to the right places. It is the opposite of a “waste” economy. A regenerative economy does not “waste” resources.

Start thinking in terms of regenerative economies. Stop thinking in terms of “waste” and throwing things out. Ask yourself, “how can I maximize the value of this thing individually and as part of the emerging circular bio-economy?”

What We Can Do

- Support the mindset shift away from waste
- Start thinking and talking about regenerative economies
- Talk to County supervisors and City managers about biomass recovery
- Use words like “local reuse” and “drawdown potential”

Get in touch with your county supervisors and elected municipal officials. Tell them that you want to see the biomass of Marin County to be managed for its drawdown potential.

Specifically, you want to make sure that the biomass is conserved and utilized within the County and that you want it to be used and managed locally in a way that maximizes their economic and ecological value.

For example, support the development of facilities that we need to have in the County. This is part of aligning consumption with production to lower carbon footprints. These could be designed to low-emission facilities if the population encourages it.

For example, we want to make sure that, if we produce compost, renewable natural gas, green hydrogen, or low-carbon electricity in Marin County that the residents of the county who are paying for all this have the ability to benefit from it. (It does not make sense for only the vineyards in northern counties to be the destination for all

the organic compost.)

For example, wood chips or piles and piles of compost are not necessarily the highest economic value outputs from the system. Engineered wood products, high-quality carbon black that can be used for next-generation battery storage, and new fuels that support zero-emission transportation can be made here and made available here in Marin – but not if we build a system that only makes mulch, compost, and natural gas – which is the trajectory that the system is headed toward if we do not reveal other options.

What We Can Do

- Support the mindset shift away from waste
- Start thinking and talking about regenerative economies
- Talk to County supervisors and City managers about biomass recovery
- Use words like “regenerative economy” and “drawdown potential”
- Support development of new biomass management facilities within Marin
- Look for products derived from recovered organics

Look for products that are derived from recovered organic products. Think about building a new eco-label like “Made from Bio in Marin.”

Further, we want Marin to be a beacon to the world. Everyone is stumbling forward with wildfire prevention to avoid further property damage or the orange atmosphere that beset the Bay Area in August. Cities and counties are working with CalRecycle, the State recycling authority, to figure out how to divert food scraps, tree trimmings, excess lumber, fire prevention wood, and just about any other kind of biomass [insert definition] from landfill. The problem is, we have not built our understanding of the recovery pathways and their relative economic potentials and climate impacts.

