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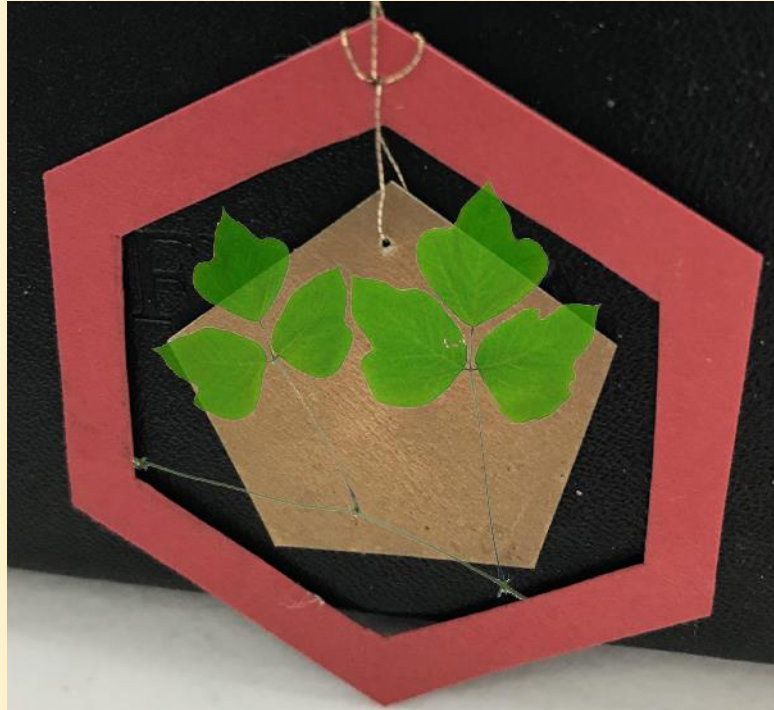


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Solstice: An Electronic Journal of Geography and Mathematics

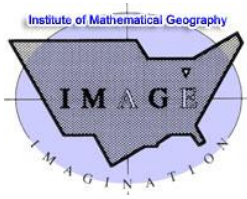
Volume XXX, Number 2
December 21, 2019

SPECIAL ISSUE ON BONUS USE



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An Electronic Journal of Geography and Mathematics

30 YEARS OF PUBLICATION!

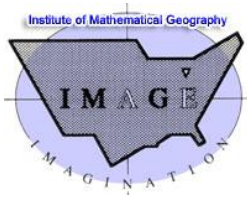
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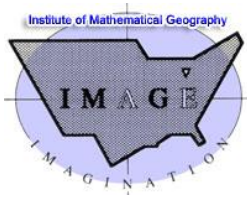
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Frontmatter

Solstice was born digital in 1990, before the advent of the Internet. Early volumes were typeset using the digital typesetting language, TeX. The digital files were sent to subscribers via email and the receiver printed out the TeX code, if desired, to produce a typeset-quality journal, on-demand. Selected monographs in the IMaGe Monograph series contain typeset versions of *Solstice*, printed from the code transmitted as the original version of that issue of *Solstice*. Later, when the Internet became available, *Solstice* switched to the Internet as the platform for transmission, writing documents in html rather than TeX.

Early in *Solstice*'s production history, some authors worried that their electronic files could be maliciously altered by random readers and uploaded to replace their own writings. Of course, that could not have happened (because everything was passworded). However, as reassurance to prospective authors not yet familiar with the mechanics of servers and such, early documents were edited to introduce deliberate errors in spacing, inserted by hand, that a random word-processed document would fail to automatically duplicate. Hence, a bogus copy could be detected simply by overlaying a 'new' printout on the 'old' printout on a light table. The hand-insertion of erroneous spaces motivated the oriental rug motif, photographed from a bokhara rug from the 1964 New York City World's Fair; that symbol is carried forward (although the practice itself is not) in *Solstice* today, as a subtle reminder of one element of the journal's history.

Over the years, *Solstice* has gained media attention from a variety of sectors: from *Science* (AAAS) and *Science News* early on. A bit later with interaction with a museum, the Exploratorium (San Francisco), and the TV show, *Nova*. For all these notices, as well as for those in more conventional academic arenas, our primary thanks go to our contributors, volunteers, and readers who have been with us for so many years. Best wishes to all!



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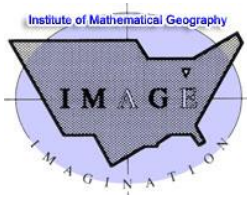
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Introduction to the Special Issue

When I learned recently that the words 'recycle' and 'reuse' raised red flags in the minds of a number of folks in at least one part of the Deep South of the USA, as 'yankee hippie' words, that prevented some from making good use of existing recycling and related concepts, it seemed that a different, and perhaps broader, term might be a good idea. Hence, the phrase 'bonus use' was born; it reflected local language that referred to a family room in a house as a 'bonus room' and to a stepchild as a 'bonus child'. A test of an indigenous Mississippi focus group showed that 'bonus use' raised no red flags and in fact was an idea they could support. Indeed, the concept of bonus use not only includes the ideas of 'recycle' and 'reuse', which apply to existing physical objects, but more broadly to objects yet to be created as well as to abstract ideas.

Bonus Uses: Here, There, Everywhere

Bonus Use: Pacemakers

A previous issue of *Solstice* noted a bonus use for cardiac pacemakers where pacemakers from the developed world find homes in those with true need in remote locations of the world. Figure 1 shows the business card for this project.



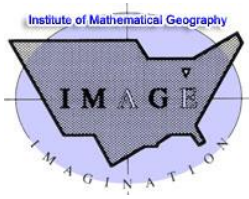
Figure 1. Pacemaker bonus use business card.

Bonus Use: Category Theory

Recently, when I was sorting through a box of odds and ends I had not looked at in years, I came across a Christmas tree ornament gift from a friend--he had made it years ago. It was a pentagon inside a hexagon with a hangar on it (Figure 2). Quite easy to make, no doubt. But who would have thought that a mathematician who presented a seminal lecture series about category theory foundations would, decades later, find a bonus use for that content in the form of a Christmas tree ornament (Mac Lane, 1963)...mathematics morphed into an ornament. Saunders Mac Lane thought so! Look around for bonus uses....likely or unlikely.



Figure 2. Christmas tree ornament.



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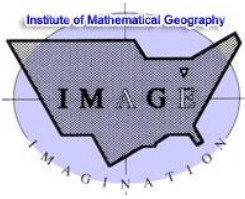
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Kudzu Cascades: Bonus Use Leads to Economic Opportunity?

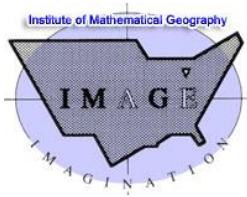
Sandra L. Arlinghaus*, William E. Arlinghaus*, Weston Lindemann*.

Introduction

Kudzu is a vine, with large dark green leaves, that is familiar to residents of the Deep South of the USA; it has been called ‘the vine that ate the South’. Kudzu cascades over trees, telephone poles, and more, as its leafy quilt covers the landscape, subtly strangling what it covers (Figure 1). To some, it resembles a topiary that is out of control; to others, it is a significant vegetative pest; and, to a small handful of others, it might represent opportunity.



Figure 1. Kudzu. Photo taken from Amtrak train, The Crescent, in Georgia, in 2018 (by S. Arlinghaus, appearing originally in *Solstice*, Volume XXIX, No. 2).



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Since the first article in this series (S. Arlinghaus, 2018) we have assembled a group in Meridian (Mississippi) to work as a team to create and implement a large project designed to take advantage of any opportunity this vine might offer to our community and to others within its natural range.

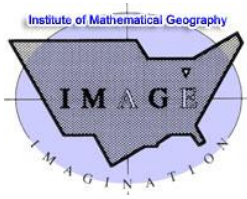
Kudzu Control: Why Does It Matter?

- Kudzu is an invasive species. According to EnvironmentalSciences.org (Hill, 2015):

Invasive species can have a number of negative impacts on the areas that they invade. Perhaps the most significant of these is the widespread loss of habitat. The hemlock woolly adelgid is an invasive insect from Asia that rapidly kills infested hemlock trees. In some parts of the Eastern United States, it is estimated that up to 80% of hemlock trees have been killed.¹⁵ These forests represent important habitat for many animals and with crucial habitat gone, species that rely on them may face extinction. Similarly, the health of many forests is threatened by kudzu vines, introduced from Japan in the 19th century as an ornamental plant.¹⁶ This plant was widely distributed across the Southeastern United States as a means of erosion control and as a food source for grazing animals. The vine soon became invasive, however, and can completely overgrow entire forests. In the process, it prevents sunlight from reaching the trees, effectively killing the forest. Additionally, the weight of the thick mats of vines on trees can cause trees to break and fall over. Its ability to quickly overgrow and destroy forests has earned it the nickname “the vine that ate the South.”

The environmental literature is filled with other references, from prestigious independent and governmental organizations from around the world, that offer good reasons to control invasive species of all sorts (one such link suggests interests in this regard of the Canadian government; [Government of Canada](http://GovernmentofCanada), 2017). One reason to control invasive species, and to control kudzu in particular, centers on greenhouse gases. Kudzu is the leading plant producer of nitrous oxide, a dangerous greenhouse gas. The amount of greenhouse gas produced annually by kudzu in the United States is significant, as noted in:

- *Proceedings of the National Academy of Sciences* publication [link](#).
- *CBS News* [link](#).
- Perhaps the most important reason to control kudzu is related to its carbon footprint. In a paper from the [New Phytologist](http://NewPhytologist), Tamura and Tharayil show (Clemson University) that invasive plants, and kudzu in particular, can accelerate the greenhouse effect as it releases carbon stored in the soil into the atmosphere (reported in *New Phytologist* as well as in other



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secondary publications (e.g. Campbell, Clemson University, 2014). They note (<https://www.sciencedaily.com/releases/2014/07/140701145720.htm>) that:

"Our findings highlight the capacity of invasive plants to effect climate change by destabilizing the carbon pool in soil and shows that invasive plants can have profound influence on our understanding to manage land in a way that mitigates carbon emissions," Tharayil said.

Tharayil estimates that kudzu invasion results in the release of 4.8 metric tons of carbon annually, equal to the amount of carbon stored in 11.8 million acres of U.S. forest.

This is the same amount of carbon emitted annually by consuming 540 million gallons of gasoline or burning 5.1 billion pounds of coal."

As these references note, extension of the numerical observations, when coupled with projected climate patterns, paint a bleak picture:

"Climate change is causing massive range expansion of many exotic and invasive plant species. As the climate warms, kudzu will continue to invade northern ecosystems, and its impact on carbon emissions will grow," Tharayil said.

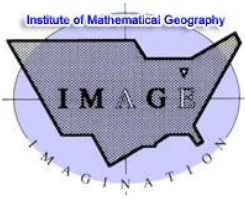
The findings provide particular insight into agricultural land-management strategies and suggest that it is the chemistry of plant biomass added to soil rather than the total amount of biomass that has the greatest influence on the ability of soil to harbor stable carbon.

"Our study indicates that incorporating legumes such as beans, peas, soybeans, peanuts and lentils that have a higher proportion of nitrogen in its biomass can accelerate the storage of carbon in soils," Tharayil said.

Tharayil's lab is following up this research to gain a deeper understanding of soil carbon storage and invasion.

Estimating Future Prospects: Green Is Green, Be It Money or Kudzu

Indeed, as alarming as this paint-by-number green picture appears to be from the static viewpoint of the previous section, when it is compounded with (as noted by Campbell) the fact that 123,552 acres (50,000 hectares) of new kudzu are forecast to be added (mainly in the Southeast), the picture becomes all the more daunting. It appears that soil release of carbon caused by kudzu is about the amount of carbon from 11.8 million acres of forest along with compounded new kudzu. That rate represents a total increase in carbon release caused by kudzu at about a rate of a bit over 10% per year. The prospect for continued growth is substantial. Over a number of years of uncontrolled growth and no meaningful management plan, such growth of carbon release would cause the total



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kudzu-promoted carbon release of the near-term future to far outstrip today's carbon footprint equivalences (of gasoline and coal-caused carbon release) of 540 million gallons of gasoline or 5.1 billion pounds of coal. The problem is a real one.

To calculate values for soil carbon release, caused by kudzu, over a user-selected period of time, we offer the following steps.

- Assume that there is some compounding of the process of growth of carbon release from kudzu over time.
- Use as a growth rate factor the value of 10%, as approximated above using data/estimates from scholars who are making educated guesses:

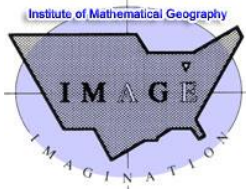
$$r = 123,552 / 11,800,000 = 0.10470508,$$

or slightly over 10% rate of increase in number of acres of kudzu in one year.

- Now, there is sufficient information to employ a standard method (based on an assumption of exponential growth) for calculating the compounding effect from the new green—as one might do in a fiscal sense. Conventionally the 'interest' being compounded is associated with money; instead, we view it as a kudzu-caused carbon release or growth.
- Figure 2 shows the steps to performing such a calculation. To do so, it is helpful to use an online exponential growth calculator, such as one found at

<https://minafi.com/exponential-growth-calculator>

Study the table in Figure 2. Consider the results from time 0; the model appears to fit the data from experts fairly well, perhaps with a bit of overfit coming from the rounded value of 10% as an estimate. Then again, it is all a very rough estimate. The model fit should give a general idea of pattern; it is a 'model' not an exact replica. The model shows that it appears 7 growing seasons is about the doubling time for the kudzu-generated carbon footprint. One could calibrate that against similar patterns for gas and coal.



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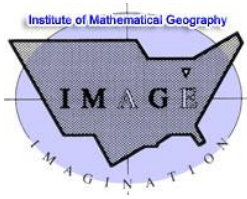
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Kudzu: exponential growth						
P(t) is future value						
P(0) is initial value						
r--interest rate expressed as a percentage						
t--time period over which interest is earned						
$P(t) = P(0) \times (1+r)^{nt}$						
Here,						
P(t)=11,800,000, the estimated forested land causing the release of 4.8 metric tons of carbon.						
P(0)=123,552 acres (50,000 hectares) of new kudzu produced from 11,800,000 acres.						
r=10%						
t=0.25 year, the estimated growing season to produce a new crop.						
$P(t)=11,800,000 \times (1 + 0.10)^{0.25} = 12,084,541.53$						
Study the pattern of growth over time (per growing season--quarter of year):						
P(t)	P(0)	r	t	P(t) after growing season X	Carbon (metric tons) per area P(t)	
12084541.53	11,800,000	0.1	0.25	Initial set: 0	4.954662028	
12375944.41	12084541.53	0.1	0.25	1	5.074137207	
12674374.08	12375944.41	0.1	0.25	2	5.196493374	
12980000	12674374.08	0.1	0.25	3	5.3218	
13292995.68	12980000	0.1	0.25	4	5.450128231	
13613538.85	13292995.68	0.1	0.25	5	5.581550928	
13941811.49	13613538.85	0.1	0.25	6	5.716142712	
14278000	13941811.49	0.1	0.25	7	5.85398	
14622295.25	14278000	0.1	0.25	8	5.995141054	
14974892.73	14622295.25	0.1	0.25	9	6.139706021	
15335992.64	14974892.73	0.1	0.25	10	6.287756983	
15705800	15335992.64	0.1	0.25	11	6.439378	
16084524.78	15705800	0.1	0.25	12	6.594655159	
16472382.01	16084524.78	0.1	0.25	13	6.753676623	
16869591.91	16472382.01	0.1	0.25	14	6.916532681	
17276380	16869591.91	0.1	0.25	14	7.0833158	
17692977.26	17276380	0.1	0.25	15	7.254120675	
18119620.21	17692977.26	0.1	0.25	16	7.429044285	
18556551.1	18119620.21	0.1	0.25	17	7.60818595	
19004018	18556551.1	0.1	0.25	18	7.79164738	
19462274.98	19004018	0.1	0.25	19	7.979532742	
19931582.23	19462274.98	0.1	0.25	20	8.171948714	
20412206.21	19931582.23	0.1	0.25	21	8.369004544	
20904419.8	20412206.21	0.1	0.25	22	8.570812118	
21408502.48	20904419.8	0.1	0.25	23	8.777486017	
21924740.45	21408502.48	0.1	0.25	24	8.989143585	
22453426.83	21924740.45	0.1	0.25	25	9.205904999	
22994861.78	22453426.83	0.1	0.25	26	9.42789333	
23549352.73	22994861.78	0.1	0.25	27	9.655234618	
24117214.5	23549352.73	0.1	0.25	28	9.888057944	

Figure 2. Kudzu, exponential growth—seven year doubling time.



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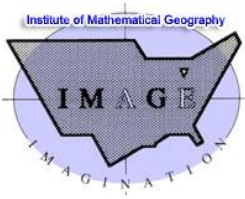
What is clear from Figure 2 is that left unchecked, kudzu will continue to be a major contributor to the carbon footprint. Thus, it becomes prudent, indeed critical, to create human intervention in the often-overlooked kudzu-carbon connection. It is to such intervention, using interesting business models, that we forge ahead on our own research frontiers.

Kudzu-Carbon Intervention

Kudzu: Supply and Demand

Clearly, there is an abundant supply of kudzu: [link to map](#). In both Georgia and Alabama, no county is spared. Outward from that core area, the spread of kudzu appears to taper off. It appears there is not demand sufficient to control it. Thus, the challenge of creating opportunity from it may involve enlarging demand as well as reducing supply. In this section, we summarize various strategies associated with viewing the control of kudzu as a problem of supply and demand.

- Supply side, ways to reduce supply through eradication: Missouri Department of Conservation, [link](#). Techniques often overlap to increase effectiveness. In some situations one set of strategies may work; in another situation, a different set may work.
 - Chemical eradication: combined management [link](#), USDA. Auburn University [link](#).
 - Mowing: [link](#).
 - Animal use: goats ([Davidson College](#)), sheep ([Georgia Tech](#)), cattle ([University of Idaho](#)).
 - Helium: [link](#).
 - Bleach: [link](#).
 - Kudzu bugs: a related pest? [Link](#) (North Carolina Cooperative Extension).



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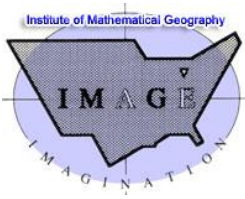
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- Demand side, reduce supply through increasing demand and ‘bonus uses’ (www.bonususe.com) :
 - There is existing demand by craft industries making baskets from vines, wreaths, and so forth. One might see various ways to enlarge this cottage industry (as it now exists) but it seems that no amount of enlargement of this particular sector alone would create demand to outstrip supply. [Link 1](#). [Link 2](#).
 - Kudzu may have only limited use as hay and animal fodder. [Link](#).
 - There is existing culinary demand. The vines are not edible for humans. The leaves and flowers may be eaten. Leaves might be prepared in a manner similar to stuffed grape leaves. Or they might be made as one makes collard greens or kale. Or they might be deep fried and served with a dipping sauce. Or dried and eaten as chips. The preparation of the leaves for human consumption is, however, time-consuming as the underside is fuzzy and not pleasant to eat. The blossoms (available only for a couple of months in the summer) are a beautiful burgundy color and might be treated as one would squash or nasturtium blossoms (stuffing them with forcemeat). The root is also edible although extracting it can be difficult. Some unusually large roots have been recorded at 200 or more pounds. The roots can be ground (much as ginger root can) and turned into a powder. Kudzu powder can be purchased online. Some of its advocates claim it is a fine hangover cure. One might also imagine using it in ways that flour or other ground vegetative matter is used in cooking. [Link 1](#). [Link 2](#).
 - A recent article, submitted the Quarterly magazine of Les Dames d’Escoffier International, documents various culinary ideas and experiments involving kudzu that have been, or are being, undertaken by members of this international organization centered on elements of haute cuisine.

Economic Opportunity

To grasp some of the variety of economic opportunity that might be available, we propose to initiate a pilot project limited to Meridian, Mississippi, (and Lauderdale County, Mississippi) with the idea that, if successful, it might then be extended regionally, then state-wide, and so forth throughout the entire



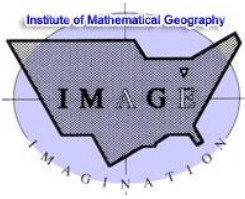
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range in which kudzu is an indigenous plant. Meridian is a small city of about 40,000 population according to the last census, but realistically local estimates are less than 40,000. Over the past few years, there has been a sudden loss of population due, in part, to a [large industry closing](#) (when funding of a state/federal source ceased). Much of this population was from elsewhere; it was a constructive population of engineers and scientists from all over the world. They introduced diverse world viewpoints and added to the otherwise-charming local culture. They also patronized local businesses, bought high-end residential properties, frequented local restaurants; theirs were stressful, and secure, jobs; they sought relaxation in the local environment and appeared to enjoy it a great deal. Their departure left a void; high-end homes are selling at tremendous discounts. Opportunity for new business and industry is wide open in many regards although the target population of customers has declined; there is room for growth in the existing infrastructure designed to support almost twice Meridian's current population. The cost of living is one of the lowest in the country. In many regards, the location in a humid subtropical climate (with definite seasons but very little snow or frost) is excellent for an industrial location whose target sales population is a national or international one (perhaps not as good for one requiring a large percentage of its activity to be local). Transportation, both regionally and nationally, is superior to what one might expect in a city of small population: there are major interstates; Amtrak has a large railroad station and associated classification yards that see heavy freight traffic of timber harvested from the surrounding pine forests; the main rail line from New Orleans to New York City passes through downtown Meridian; The Crescent, Amtrak's oldest passenger train, makes the trip to and from New Orleans and New York on a daily basis with regular stops in Meridian; New Orleans (200 miles away) is a quick drive on good roads or a ride on The Crescent; airline traffic is extensive—Naval Air Station Meridian trains first-strike pilots from around the globe; and Key Field in Meridian boasts the longest runway in Mississippi (perhaps the only one long enough to accommodate Air Force One); American Airlines has small jet transit non-stop to O'Hare in Chicago and to Hattiesburg-Dallas on a daily basis. Industrial headquarters might well benefit from a location such as this; and the city would benefit, economically, from the introduction of new large businesses. The idea is to create a win-win situation. That idea, however, needs to be limited within environmental parameters, so that the benefit to the local community is not destructive to its existing fine qualities in the heart of the



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southern pine belt, with the best city water in the state and air quality that consistently rates as 'good' or better (with the heavy pollutant being pine pollen in the spring).

Meridian seems, therefore, to be a fine choice for a pilot project to determine how to introduce heavy industry, and associated economic opportunity, in a situation where it is needed, but to do so without consequent environmental damage. History is replete with communities that have seized similar opportunities. Often, however, the unintended consequences that have developed down the road in encouraging such development have had negative environmental consequences. We seek to create a situation in which other local resources can offset such possible negative impacts.

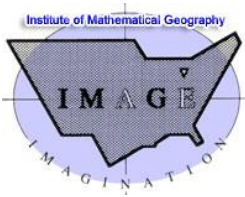
Economic Opportunity and Energy Credits Lead to Positive Urban and Environmental Planning

One such local resource, to offset negative impacts, may be kudzu. Given that:

- kudzu is the plant producing the single greatest amount of greenhouse gas (nitrous oxide among others)
- kudzu accelerates the release of carbon from the soil, thereby adding substantially to the carbon footprint (Figure 2)
- kudzu is present in substantial amounts within Meridian and its surrounding urban area (Lauderdale County).

Taken together, these three observations suggest that industries might be encouraged to locate, or relocate, in Meridian when offered an ENERGY CREDIT (strategy suggested by W. E. Arlinghaus), based on their clearance of existing kudzu with the size of the credit directly proportional to the amount of kudzu cleanup performed. Indeed, an added amount might also become available for new plantings that stabilize carbon in the soil.

The addition of an Energy Credit to otherwise attractive local advantage (such as fine transportation linkage at the national level), might be just the sort of encouragement needed to entice substantial industrial complexes to this location. To implement such a pilot project, local government may issue a request for bids to locate to Meridian, or some sort of tax-increment financing, linked to positive



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environmental management (particularly associated with kudzu) and kudzu removal / carbon footprint reduction.

City Council member Weston Lindemann is currently exploring this prospect. The current effort involves verifying what sorts of numbers the Municipal Governments and the Federal Government (EPA for example) might need to see in order to determine the feasibility or validity of implementing the pilot project, and then of assessing plans to move forward, based on pilot success, of broader related projects. In particular, in addition to the calculations above, it will be critical to know how much Greenhouse Gas is produced, per acre, by various industrial activities as well as by an acre of established kudzu. Only then can we create a clear balance sheet for future possibilities to implement, governmentally-approved, balanced Emissions Trading Policy involving Energy Credits. As Council Person Lindemann notes:

I'd like to be able to list details for the proposed emissions trading program. To do so will require a better understanding of how much GHG kudzu emits, EPA emissions standards, and having a system for assigning value to kudzu removal based on GHG levels.

An opportunity exists in the city of Meridian to A.) reduce municipal costs associated with wastewater systems and B.) Incentivize economic development while converting to green infrastructure.

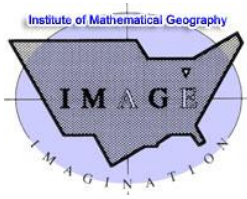
Kudzu, known as "the vine that ate the south", increases nitrate drainage into water ecosystems (Mississippi Encyclopedia). By leveraging the resources available to be committed to the removal of kudzu, opportunity exists for economic development.

"The Mississippi Kudzu Coalition has worked to utilize state and federal grants to provide education to the public about kudzu and control methods and have set a goal of eradicating 90 percent of the kudzu in North Mississippi. Other proposals would utilize kudzu as a source for ethanol and for folk medicines. Cookbooks have suggested using kudzu for salad greens and in kudzu flower wine. Basket makers and other folk artists have found their own uses for the vine." (Mississippi Encyclopedia.)

Environmentally focused groups recognize the issues associated with Kudzu's pervasiveness, particularly in the southeast United States. As a result, organizations of this type are likely to contribute financially to a municipality's efforts at reducing Kudzu. Given Kudzu's greenhouse gas emissions, an unlikely union of private industry and the Environmental Protection Agency may find common cause in its' removal.

By establishing an EPA approved Emissions Trading policy, the city of Meridian will be in a position to offer private industries that emit greenhouse gases an exclusive opportunity to emit greater amounts of GHG, in proportion to the amount of kudzu removed within City of Meridian (Lauderdale County?) limits. This opportunity will spur economic development in Meridian, as the trend of industry relocating to countries offering lax emissions standards can be in part attributed to the EPA's lack of existing alternatives. By providing a GHG neutral alternative, the city of Meridian can attract greater industrial development without negatively impacting the environment.

Given Kudzu's widespread existence, opportunity exists not only by way of incentivizing economic development through the value of its' removal, but also in converting to green infrastructure. Using a



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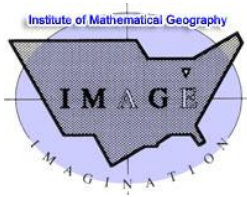
combination of municipal funds, federal and NGO grants, and the GHG emissions allowance available to industry engaged in kudzu removal, the city of Meridian can drastically reduce costs of complying with the ongoing EPA consent decree.

Tax Increment Financing (TIF) could be a useful tool to encourage bonus use of Kudzu after its removal. For instance, a company that sells a product made from Kudzu harvested in Meridian could have substantial startup costs covered by the TIF. The sales tax generated from selling said Kudzu based product would be used to pay back the city.

Indeed, there may be many fine ideas, from the local to the global, that fit within this general style of 'energy credit' context. Political leanings on the topic may come and go; the basic idea, however, remains fixed: clean up the environmental mess before more strain on the environment is introduced. Keep track of the balance in some sort of energy bank, with green credits and green expenditures. Improve the natural and economic environments hand-in-hand in a constructive and creative partnership across many arenas. Stay tuned for further development of this urban and environmental planning project as it evolves in regard to kudzu.

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Related Materials

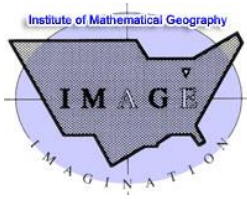
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*Appendix.

Project Team.

Principals:

- Sandra L. Arlinghaus, Ph.D., Mathematical Geography. Adjunct Professor, University of Michigan Ann Arbor, School for Environment and Sustainability. She is the initiator of a kudzu-based project in Meridian and the primary author of this article. Co-founder and Past President, Ann Arbor Chapter of [Les Dames d'Escoffier International](#); Dual Member, Chicago Chapter. Meridian MS. <http://www-personal.umich.edu/~sarhaus/>



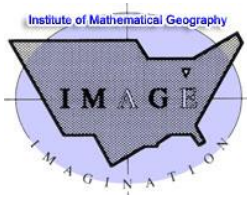
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- William E. Arlinghaus, B.A., Linguistics. Owner, Brickhaus Brewtique, Meridian, MS. He is the creator of the idea of a kudzu energy credit exchange to promote new business.
- Weston Lindemann, City Council Member, Meridian, MS. He interrupted his formal education at Millsaps College to work on the Hillary Clinton campaign. A native of Meridian, he returned home after the campaign and showed political talent great enough to get himself elected as a Democrat to Meridian City Council, at the age of 20, against an established Republican incumbent.



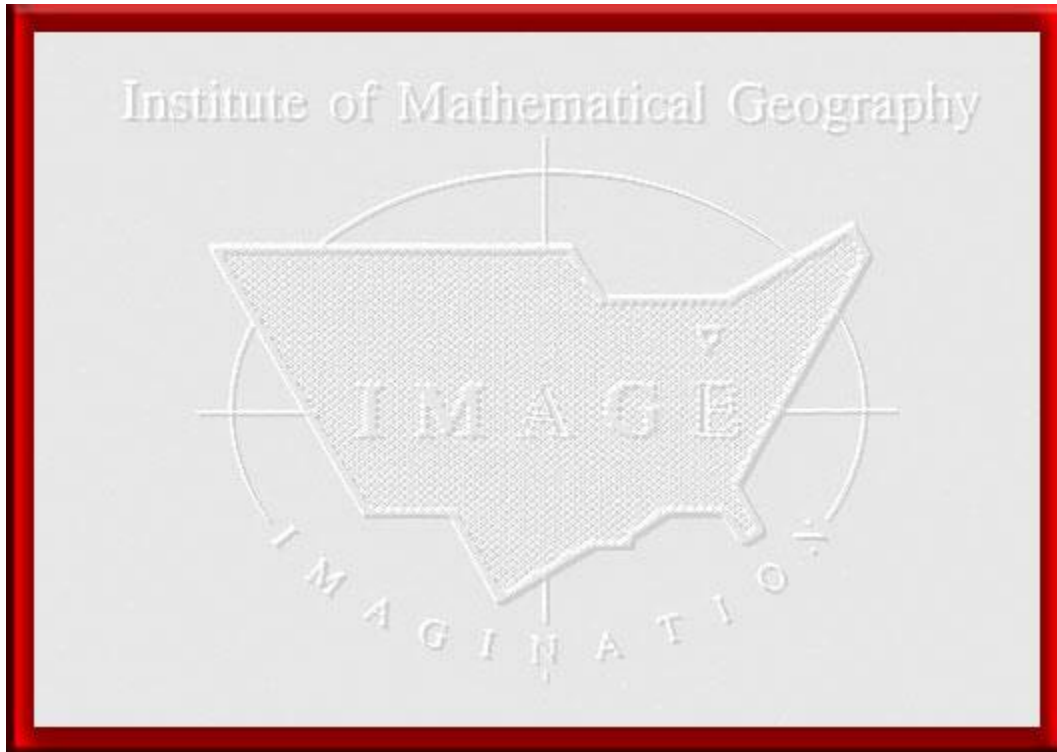
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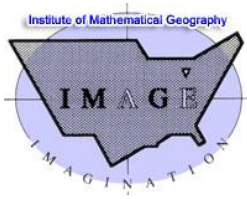
Endmatter



Original logo designed by Sandra L. Arlinghaus and stylized and redrafted by Allen K. Philbrick.

AWARDS AND SELECTED COMMENTS

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- One article in *Solstice* was a Pirelli INTERNETional Award Semi-Finalist, 2003 (Spatial Synthesis Sampler).
- *American Mathematical Monthly*, September 1992, in Telegraphic Reviews section notes *Solstice* as "one of the world's first electronic journals using TeX." L. A. Steen.
- [Science News](#), 25 January, 1992. Article about *Solstice*.
- [Science](#), AAAS, 29 November, 1991. Article about *Solstice*.



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