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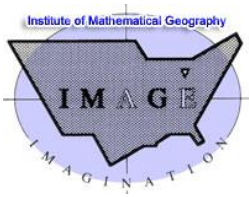
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SOLSTICE:

An Electronic Journal of Geography and Mathematics

35 YEARS OF PUBLICATION!

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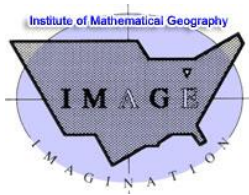
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Virtual reality of The University of Michigan “Diag”, below. Note the observatory dome atop Angell Hall, in the foreground.



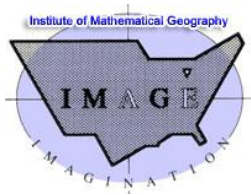
The IMAge website, housed in the persistent file storage, Deep Blue, at the University of Michigan; one might find it by searching the Communities and Collections section of Deep Blue Documents, under Mathematical Geography, Institute of (IMaGe).

On that site, in addition to *Solstice*, the full IMAge *Monograph Series*, IMAge *eBooks*, and the new (2022) feature, *The Living IMAge*, are housed. There are files from other sources, including the full set of documents of the *Michigan Community of Mathematical Geographers* (MICMOG). Scroll down, on the IMAge home page, to find these files and more.



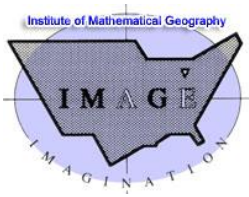
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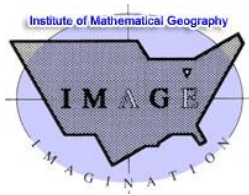
Frontmatter

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!

Founder and Editor-in-Chief: Sandra Lach Arlinghaus. Contact for article, note, or comment submission information: sarhaus@umich.edu



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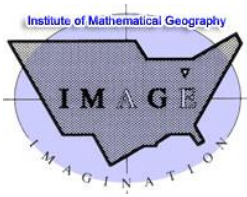
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Guest Guide in this issue: Scaffoo (created by S. Arlinghaus), derivative of the *Solutions Guide* noted in the references section of the first article, below. Meet a 'guide' who moves through portions, perhaps seemingly unrelated, of this document. Scaffoo is descended from the wise Snowy Owl, filtered through Ookpik (a Canadian Intuit symbol of good luck based on the Snowy Owl), and emerging as an imaginary friend. He is the combination of the Earthly wisdom of the owl, with a conceptual perspective on mathematics and mapping. In what follows, look for Scaffoo as a fun guide to make interdisciplinary connections!



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Maps and Math: Identifying Learning Opportunities, Part 2

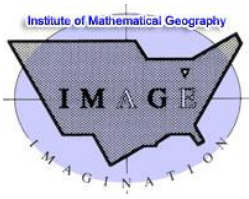
Sandra L. Arlinghaus
With input as noted from Joseph J. Kerski, and William C. Arlinghaus
Guest 'guide': Scaffoo

Any map presents opportunities to learn about mathematics. The challenge is to identify what those opportunities might be. We illustrate in Part 2 of this topic how a creative instructor might engage in that requisite identification. In [Part 1](#), we illustrated that any single mapping activity might give rise to a wide variety of associated opportunities for teaching different branches of mathematics and followed that general overview with a detailed example involving locational coordinates for the Eiffel Tower (also, Arlinghaus, Kerski, Arlinghaus, 2023). We noted that the thoughtful reader will imagine how other mapping activities might be created. We illustrate another one, here.



Maps...

Many people know that Australia and the United States of America are very roughly close in size in area, with the USA larger: [Australia](#): 2,967,909 square miles, [USA](#): 3,809,525 square miles.



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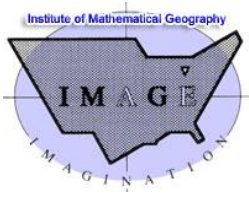
Hopefully, our intuitive visual picture fits with the data as we visualize a globe and mentally compare the size of these two countries.

The globe often has a support for its stand poking up through Antarctica. If we want to know relative sizes of Antarctica and Australia, our existing visual support mental map may not serve us well. We look up the area and find that [Antarctica](#) is roughly 5,500,000 square miles. But let's see if we can do better with the visualization, as well.

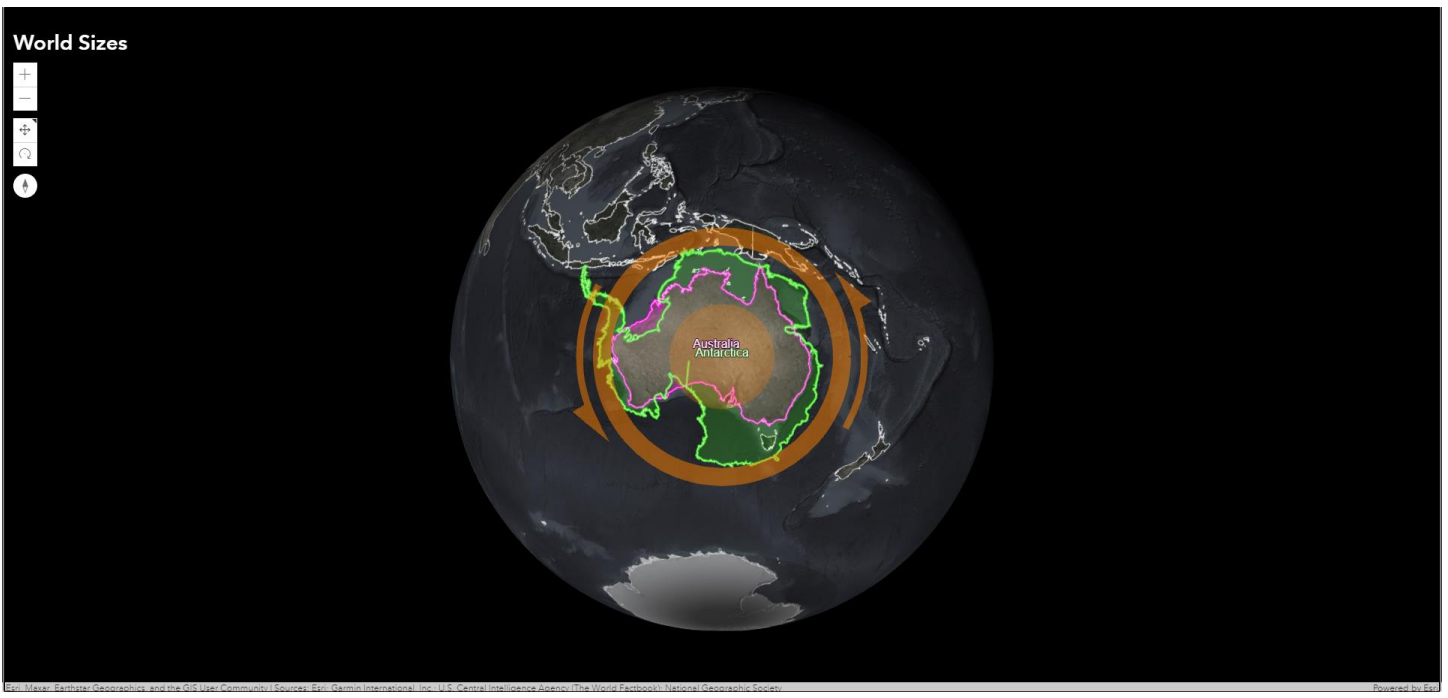
Open the following 3D web mapping application to compare the sizes of countries:

<https://arnofiva.github.io/world-sizes/> Click on a country > use the controller bars that appear to move that country to another location on the Earth.

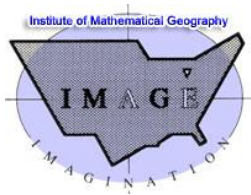
In the example below, notice that we 'moved' Antarctica to superimpose on Australia. What happens if we try to move Australia to superimpose on Antarctica? Notice that there appears to be a singularity at the South Pole, so that the overlap is not smooth. Try it...look at overfit and underfit. Is it possible to slide Antarctica around enough so that its boundary totally contains Australia's boundary? Why are overfit and underfit important? How do they contribute to clear visualization? Where else do these ideas arise?



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Comparing the sizes of Australia and Antarctica using an interactive 3D web mapping application. ArcGIS API from Esri.



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Try your hand at 'mathing'
as you read...interactively!

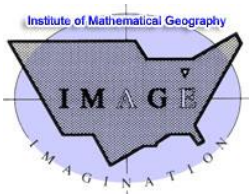
Math...

Graph Paper Measurements of Underfit and Overfit

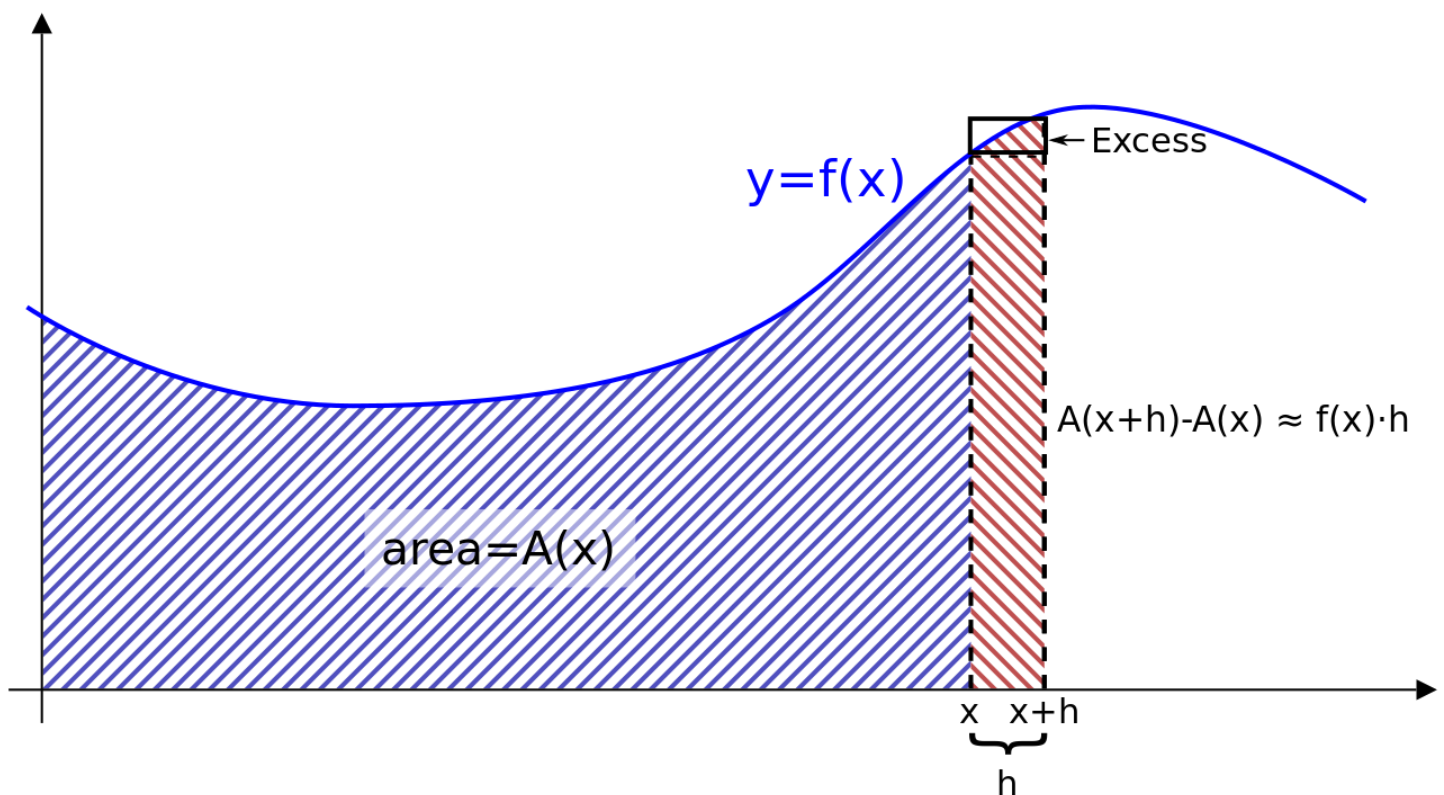
A simple way to measure the area of an irregular closed curve, that many of us might have learned in grade school, is to lay a piece of graph paper under the curve (whether the curve is drawn directly onto the graph paper or on a sheet of regular paper which is then overlain on graph paper and lit from behind) and count the number of squares filling the region. In addition, fractional overfit and underfit refine the simple square counting. And, the thoughtful teacher will provide graph paper samples of differing grid spacing so that the student sees that a finer partition gives better results.

Fundamental Theorem of Calculus

Beyond the simple graph paper measurement involving overfit and underfit a deeper result, that may trigger memories involving improving measurement using finer partitions on graph paper, arises in the Fundamental Theorem of Calculus. The theorem is 'Fundamental' because it links the two great operations, new (for the student) in the Calculus, of differentiation and integration. In a geometric interpretation, the idea of 'excess' or overfit/underfit, is critical. The diagram below suggests a

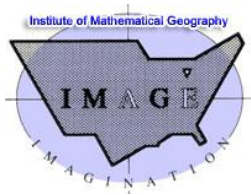


strategy for calculating the area under a curve using slabs as approximations, with the 'excess' filling in to make the fit exact. As the width of the slab decreases, the accuracy of the approximation improves. Study the material in the [link](#) that leads to this diagram.



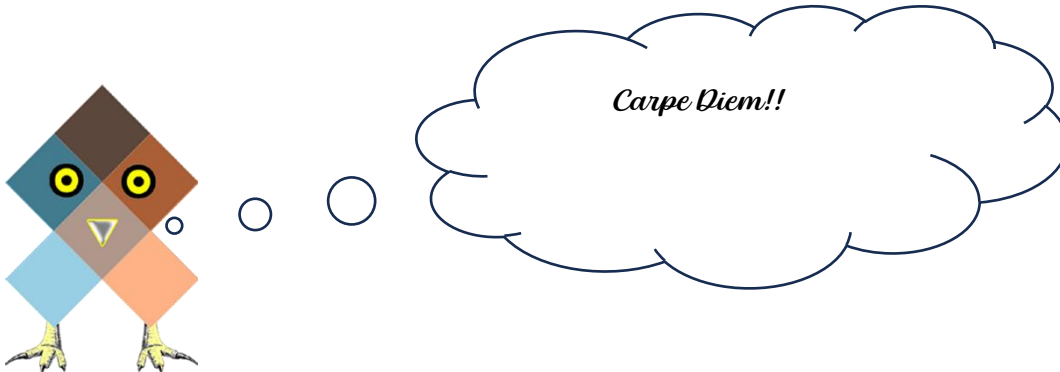
Source: <https://commons.wikimedia.org/w/index.php?title=User:Kabel&action=edit&redlink=1>

Then, scroll down to see an animation, also involving overfit and underfit, using Riemann sums. In all cases, the idea of limit, often first seen in Calculus courses, is employed to capture the idea of shrinking slab width to become arbitrarily small. Infinite processes are introduced, often for the first



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time. The power of this theorem is enormous, both in what it does in unifying Calculus itself, and also in its richness as a teaching tool.



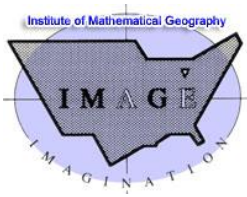
Opportunities

Teaching opportunities centered on mapping at a general level might involve introducing how map scale affects the overlay of maps. Or, more advanced, how map projection might influence overlay (Arlinghaus, Kerski, and Arlinghaus, 2023).

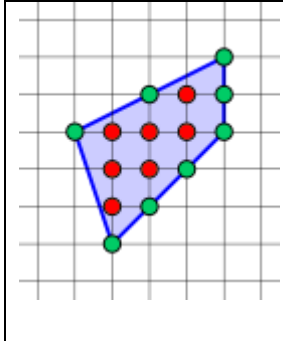
At each stage in the mathematical journey, from size comparisons using grid cells, to the Fundamental Theorem of Calculus, there is abundant opportunity to take side tracks to explore reinforcement of ideas and discover new connections.

Pick's Theorem and Euler's Formula

Focusing on the measurement of polygons, an interesting approach, again centered on graph paper style of analysis, arises in Pick's Theorem.



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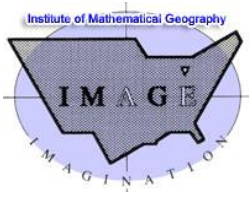
Pick's theorem expresses the area, A , of a simple polygon with integer vertex coordinates, i , in terms of the number of integer points within it and on its boundary, b , generally as $A = i + (b/2) - 1$. In the example to the left, $i = 7$, $b = 8$, thus $A = i + (b/2) - 1 = 10$

Source: https://commons.wikimedia.org/wiki/File:Pick_theorem_simple.svg

One proof of this theorem involves the use of Euler's Formula and a subdivision of a given polygon into triangles. Then, viewing that subdivision (think 'partition' again) as a planar graph, Euler's Formula $V - E + F = 2$ may be applied to the vertices, V , the edges, E , and the faces, F , of that planar graph. Read more about this use of Euler's Formula on this [link](#). Jump from this link to more general articles on Graph Theory or on Geometry; a wide variety is available.

Measure Theory: Inner and Outer Measure

One more advanced extension of the ideas of measurement involves the mathematics of measure theory. Keeping in mind the broad ideas of overfit/underfit may foster an intuitive base from which to approach this far more detailed, and notational, branch of mathematics. And, in parallel to what we did above with first looking at measurement and then at integration, Measure Theory often serves as a preliminary to studying more advanced Integration Theory. There are many starting points available on the internet; most assume that the reader majored in mathematics at the undergraduate level: [link](#).



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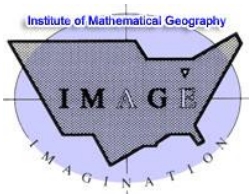
Hausdorff Dimension

As one moves forward with intricacies associated with the concept of ‘measure’, it becomes natural also to think of concepts associated with ‘dimension.’ The usual dimension that people understand intuitively is a straightforward view of Hausdorff Dimension. Read the associated material to dig more deeply into that concept: [link](#).

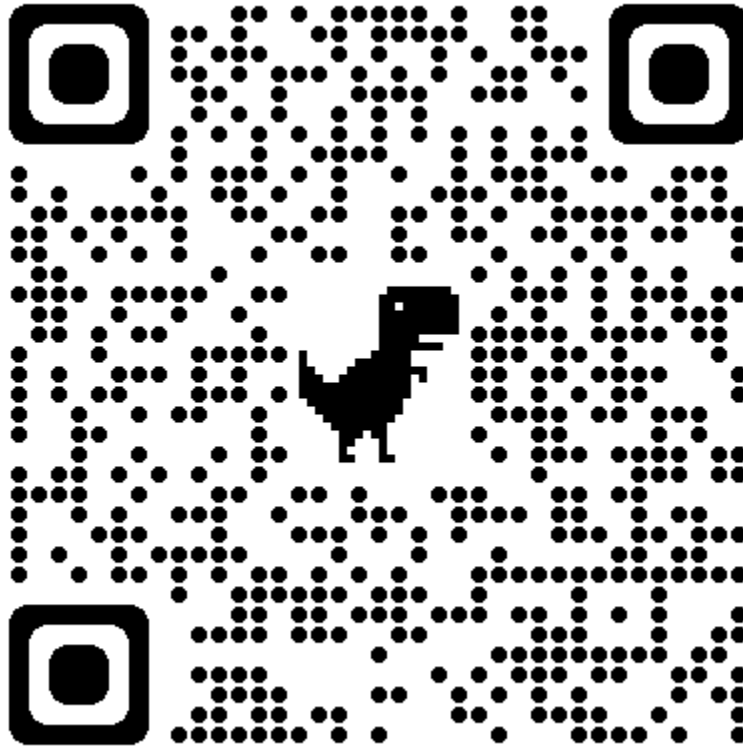
Once the idea that dimension might involve more than simply thinking a square has dimension 2 and a cube has dimension 3, it is natural to consider the history and some of the more recent work involving fractional, rather than only integral, dimensions.

Fractal Dimension

The fractal dimension can assume non-integer values. There are sets that ‘fill’ space qualitatively and quantitatively differently from how a typical geometrical set fills space. Scan the QR code below to see an animation of the Koch curve: [link](#). Note the repeated simple pattern, the generator, that gets scaled to fit successive sides of the polygon to which it is applied. The result, through the application of this self-similarity transformation, is a curve that fills more and more space (intuitively) but never really fills it solidly as gaps remain. Here, circle back to geographic concepts with the idea of scaling, but with them applied to geometric entities...truly mathematical geography, at least at the conceptual level.



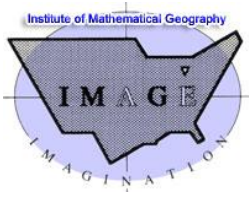
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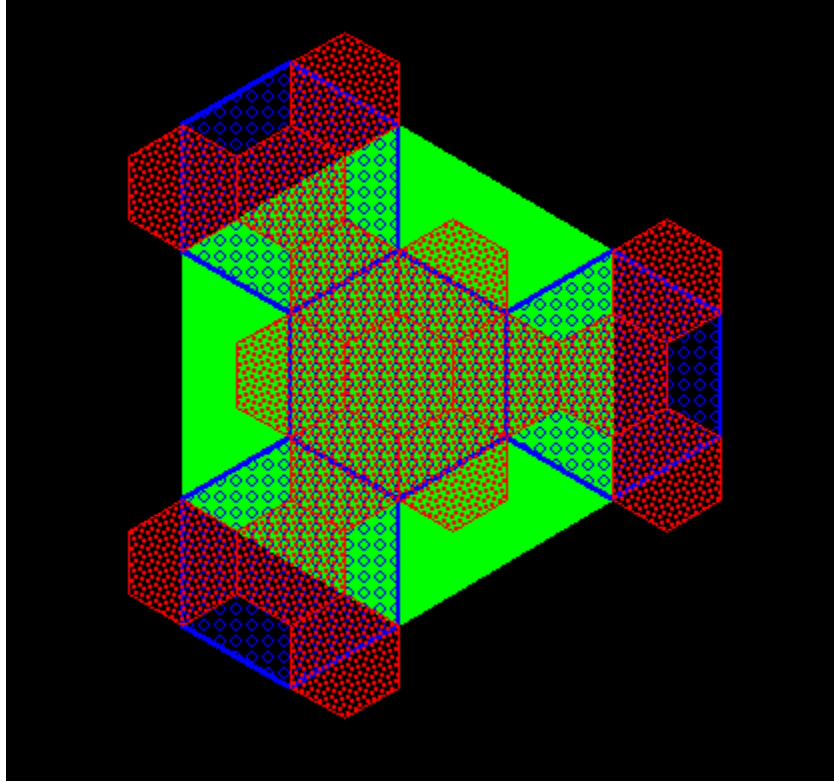
Source: <https://commons.wikimedia.org/wiki/File:Blueclineani2.gif>

Fractals and Central Place Theory

The fractal style of construction, using a suitably chosen generator, may be employed to create classical Central Place Theory nets (Arlinghaus, 1985; Arlinghaus and Arlinghaus, 1989). A geometric snapshot of one such configuration is shown below. Can you pick out the generator applied to the side of a hexagon? How do the concepts of overfit/underfit come into play? To learn more and see animated images, go to the following [link](#).



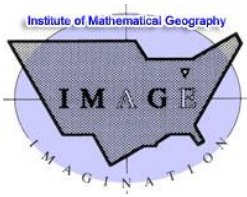
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K=4 central place tile. Fractally-generated layers stacked on a single hexagonal tile.

Source: <https://public.websites.umich.edu/~copyright/image/books/Spatial%20Synthesis2/chapter2.html>

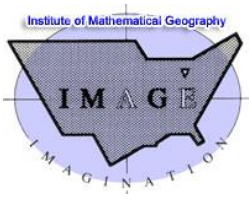
Thus, we have now traveled full-circle, through various theoretical realms, back into the real world of looking at how cities might share space! What interesting adventures can you create in joining the various worlds, academic or otherwise, in which you live?



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References

- Arlinghaus, Sandra L. 1985. "Fractals take a central place," *Geografiska Annaler*, 67B, (1985), pp. 83-88. Journal of the Stockholm School of Economics.
- Arlinghaus, Sandra L.; Kerski, Joseph J.; and Arlinghaus, William C. 2023 (December). *Teaching Mathematics Using Interactive Mapping*. Boca Raton: CRC Press, [Taylor & Francis Group](#).
 - Video describing general nature of this book:
https://youtu.be/Lkcnrohzbm0?si=qRqJyCp_TJ9-qdBC
 - Video describing maps in this book:
<https://youtu.be/GqisuReZoO4?si=orXzkOaW6WXpRZpo>
 - Print: [Routledge](#).
- Arlinghaus, Sandra L.; Kerski, Joseph J.; and Arlinghaus, William C. 2023 (December). *Solutions Guide to Teaching Mathematics Using Interactive Mapping*.
- Arlinghaus, Sandra L. and Arlinghaus, William C. 1989. "The fractal theory of central place hierarchies: a Diophantine analysis of fractal generators for arbitrary Löschian numbers," *Geographical Analysis: an International Journal of Theoretical Geography*. Ohio State University Press. Vol. 21, No. 2; pp. 103-121.
- Arlinghaus, Sandra Lach and Arlinghaus, William Charles. June 21, 2005. [Spatial Synthesis, Volume I: Centrality and Hierarchy. Book 1](#) (online non-persistent link). Persistent link to pdf of book with attached animations (use a full pdf reader to see the attached images): [Spatial Synthesis, Volume I Book 1](#). Page with associated zipped interactive maps for individual download to accompany persistent pdf and also separate chapter/section pdfs: [Link](#).



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Kudzu Project Update

Sandra L. Arlinghaus and William E. Arlinghaus

Introduction

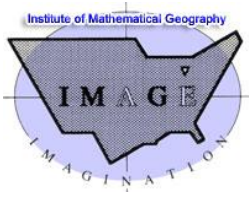
Kudzu is a leafy green plant that cascades over existing vegetation, telephone poles, and even buildings, as it sprawls across the landscape choking out sunlight, and therefore life, for all that it covers. One method for its control, largely untapped, is to eat kudzu: to transform a serious problem from an invasive plant into a constructive edible for a broad segment of human population.

There are about 7.3 million acres of kudzu growing wild in the southeastern part of the USA. It is human food that is treated as a waste product, at best, when instead it might be used as food. Even worse, it is a net emitter of carbon as it grows at breakneck speed creating large rootballs (of up to about 400 pounds) that fracture the soil open as the plant invades the landscape, often with a foot of growth per day.

In an effort to balance the large supply of existing wild kudzu with a created large demand, one critical goal of this project is to lead humans to choose to eat kudzu. In references cited at the end of this article, we presented various efforts in this direction, involving kickoff events, suited to the spring and summer weather. With Autumn, came tougher kudzu and eventually no kudzu for harvest.

Winter Progress

Over the past winter, our team has continued to work in directions not reliant on having a ready supply of fresh, green kudzu leaves. Initially, we tried to freeze the tough, mature kudzu leaves. We froze them on the vine, wrapped in plastic—as perhaps the easiest way to deal quickly with a



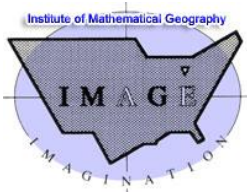
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possible large, simultaneous, influx of thousands of leaves. That process did not work well; the plant material froze quickly, but when thawed it became smelly and unattractive. We tried that simple process in two different freezers: one home freezer and one commercial freezer. We did not pursue this approach with any more mature kudzu leaves; if we had, the next step might have been to remove the leaves from the vines, parboil the leaves, chop the leaves, and package them in an airtight container. That strategy would create a huge increase in processing costs and time and, we thought, was best left to commercial/industrial establishments that already had facilities in place for such procedures (such as companies that produce packages of frozen chopped spinach for supermarkets) to be executed in a safe manner.

Thus, we proceeded with cooking with other leafy greens with the idea that what works for various leafy greens would likely also work for kudzu. In addition to regular cooking with fresh organic spinach, rainbow Swiss chard, and kale, we also experimented with broccoli leaves. These leaves were a beautiful deep green and larger than young kudzu leaves. We found that eaten raw, they had a mild flavor that tasted a bit like broccoli and that they made an outstanding side dish when briefly cooked in chicken stock and served with butter, as one might with spinach leaves. They were also attractive when used as a garnish or as a base on which to place cheese on a serving board or platter. We found that patrons at the Brickhaus enjoyed shredded broccoli leaves, served instead of shredded head lettuce, on chicken breast sliders.

In summary, we became convinced from our various efforts over the past year that:

- Kudzu made a fine garnish on serving platters.



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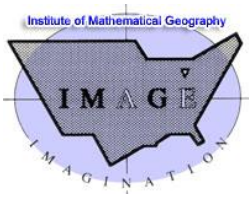
- Young kudzu worked well as a leaf to wrap around sausages (or others) in much the way that one might use grape leaves.
- It was likely that young kudzu would work well in any conventional dish, such as spinach lasagna, mixed greens salad, and more. That it could be served alone, or in combination with other greens so that, for example, spinach might be used together with kudzu in creating a green layer within lasagna.
 - Kudzu, alone, has a somewhat grassy flavor but is generally mild-flavored with a verdant appearance when eaten raw or lightly cooked.
 - Kudzu leaves take on the flavor of what they are being cooked with. Thus, it is a taste that is easy to acquire.

What has also become evident over time, is that the biggest problem in converting kudzu into a crop eaten by humans, at least within the local realm of the Deep South where kudzu is dominant, is one of perception. Many of the people who were actively interested in eating it with us, as guests, were not from a hometown where kudzu was prevalent.

Kudzu Resistance

We have had the opportunity to talk to local folks about their attitudes toward kudzu. The most common reactions to the question, “would you eat kudzu” are disbelief expressed in various ways:

“What??? Kudzu??? Is it edible?? NO! Why would I eat that. It’s a disgusting common weed! No way!! YUCK!”



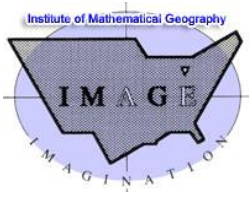
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When we asked why they felt this way about it, there typically was no further additional articulation. When we pursued the issue, and asked how they thought it might be different from eating kale, for example, again there was sometimes no further comment other than repetition of the first reaction, but also there was growing hostility. Over the winter, we found this reaction to be a consistent pattern.

One woman said that not only would she refuse to eat it, serve it, or recommend it, but also that it had no nutritional value. When we offered her a reference to the contrary (on the latter point) she refused to take it. About a month later, when we saw her briefly, she asked if we were still interested in that 'stuff' (meaning eating kudzu). When we assured her that we were, she just shook her head with clear disdain. We talked to a man, over 85 years of age, who was clearly adamant that one does not eat kudzu, nor should one even consider such an idea. The wisdom of his years had not landed on the prospect of human consumption of kudzu. Then, just recently, we were both talking to an African-American man who said yes, he had lived his whole life in East Central Mississippi and of course he ate kudzu. He said it was good and that he liked it, as he liked collards. As Bill and I thought about the cultural background of those who had expressed negativity toward kudzu, we concluded that they were probably all from a Southern white background (predominantly male, but some female).

Perhaps the sample we had talked to needed enlargement.

Our next step is to see if we can locate others, across a broad cultural local spectrum, who already eat kudzu and then to work with the local churches these people are affiliated with to see if larger organizations of individuals might be interested in harvesting wild kudzu as a way to feed those in need. We might also learn a great deal from them about how they already enjoy preparing kudzu; do



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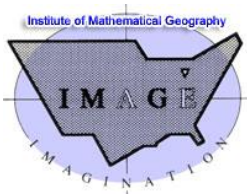
they add sugar to water or stock they boil it in? Do they add spices of various kinds? Do they serve creamed kudzu? Do they serve pickled kudzu? Do they use it as a 'mix-in' of some sort? What sorts of pairings do they consider? And more...

East Central Mississippi appears to be a community that prides itself on taking care of those who are less fortunate than most, often through church and other outreach efforts. Perhaps kudzu harvesting (acres of 'free' food) would be something they could get behind, from serving kudzu dinners at the church to outreach in overcoming produce-inadequacy in local food deserts. Time will tell.

Haute Cuisine Connection

Once the ready adopters have encouragement to continue eating kudzu, perhaps through local churches, then we seek to educate others to the possibility of eating kudzu. When people see kudzu as a simple replacement for spinach, kale, or other habitually-eaten greens, they may see no particular reason to incorporate them into their diets—despite pleas from well-meaning academics and other environmental advocates to do so. People need to choose what to eat, rather than be told what to eat. Most mothers of toddlers know this: give the child a choice from among three vegetables rather than just shoving your choice at him. Then, the child has partial ownership of the process and wants to like the choice he made.

And that sort of process applies elsewhere, as well. Give an adult a choice between a yellow snack cake filled with fake crème and a French éclair made from scratch pâte à choux dough and filled with handmade crème patissière, all topped with dark chocolate ganache. Some adults may choose the snack cake for dessert but most will probably choose the éclair. They should be free to choose for



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themselves; however, wonderful cuisine can help to educate and thereby guide choice in a desired direction.

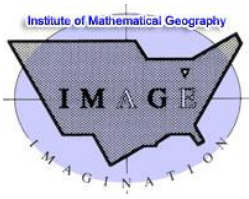
So, once we all know how to include kudzu in salads, in pasta dishes, as a creamed side dish, or as a pickled topping for burgers, it is time for classical haute cuisine to enter the picture. To offer extra, perhaps particularly desirable, alternatives that increase kudzu demand as they focus on other well thought-out ingredients in association with constructive environmental pictures. And that is where we enlist the aid of Les Dames d'Escoffier, and others, to help lend a creative culinary, as well as marketing, helping hand.

Imagine, for example, chefs on the Food Network TV shows, such as Chopped, challenging contestants to come up with creative ideas for making intensive use of premium-Meridian wild kudzu? Or Guy Fieri, visiting local diners that make interesting use of kudzu? Thousands and thousands of followers are influenced by these shows, from the diner to the luxury restaurant. Create demand for kudzu, designed to exhaust its wildly overwhelming supply, by increasing its panache!

Kudzu: Next Steps of William E. Arlinghaus

A Major Green Industry—Future Dream?

Imagine, a Deep South embracing eating kudzu in the future much as folks there eat collard greens today. Everyone knows how to cook them. Chefs and homemakers, grandmothers and school teachers, all pride themselves on their own personal touches for making kudzu special for their loved ones, customers, and students. The burden of kudzu is diminishing and its invasive character is no longer a particular threat. We know how to control it although it remains present among us (perhaps



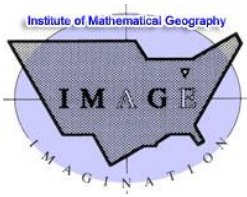
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a lesson learned with the recent pandemic?). The demand for kudzu now outstrips its supply; the carbon footprint of kudzu has been reduced; native plants are surviving and thriving. Life is good, in terms of the threat from kudzu.

How do we make this dream a reality? The answer may lie in developing kudzu as a green industry. Envision it as headquartered in Meridian, to take advantage of numerous opportunities such as 'premium kudzu' (fed only from the finest waters from the PFA-free aquifer underlying East Central Mississippi). House the headquarters in an historic building, such as the Temple Theater, that would benefit from such a restoration and usage. As the current downtown Meridian Renaissance evolves, Green Kudzu LLC, could become part of that with an eventual buildout of hiring 500 local workers, at various educational levels, many from the local resource base. We would need harvesters, food processors, chefs, packagers, administrators, landscape architects, environmental scientists, teachers, and a host of others. And we would need avenues for funding, perhaps through governmental grants of sorts, awards from various entities, or support from human demand sustained over time. As the kudzu problem becomes controlled, we might morph one successful strategy to manage other similar problems with wild bamboo, seaweed, and more. The prospects seem unlimited: the key is to turn apparent disadvantage into advantage through creative effort.

Previous material on the Kudzu Project

The list below enumerates our effort of published materials on this topic, to date. If no author is specified, then it is the *Solstice* Editor who wrote about the topic.



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2023, December. *Solstice: An Electronic Journal of Geography and Mathematics.* Ann Arbor: Institute of Mathematical Geography, [Volume 34, Number 2](#). December 21, 2023.

- Update: Kudzu Project (Sandra L. Arlinghaus)
- Kudzu Project: Beyond the Kickoff (Sandra L. Arlinghaus)

2023, June. *Solstice: An Electronic Journal of Geography and Mathematics.* Ann Arbor: Institute of Mathematical Geography, [Volume 34](#), Number 1. June 21, 2023.

Special Issue: Kudzu Kickoff

- Kudzu Kickoff--Initiation (Sandra L. Arlinghaus)
- Kudzu Kickoff: March 26 and May7 (William E. Arlinghaus)

2021, December. *Solstice: An Electronic Journal of Geography and Mathematics.* Ann Arbor: Institute of Mathematical Geography, [Volume 32](#), Number 2. December 21, 2021.

“Update on Activities (Water supply/aquifer free from PFAs).”

2021, June. *Solstice: An Electronic Journal of Geography and Mathematics.* Ann Arbor: Institute of Mathematical Geography, [Volume 32](#), Number 1. June 20, 2021.

“Update on Activities (Kudzu Project).”

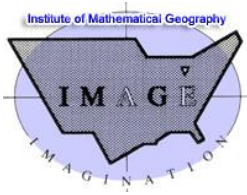
2020, December. *Solstice: An Electronic Journal of Geography and Mathematics.* Ann Arbor: Institute of Mathematical Geography, [Volume 31](#), Number 2. December 21, 2020.

- “Update on Activities (History Garden).”
- “Planning Units: Kudzu Opportunity Zones?” Sandra L. Arlinghaus, William E. Arlinghaus, and Weston Lindemann
- “Kudzu, Carbon Footprint, and Bioplastics.” Sandra L. Arlinghaus, William E. Arlinghaus, and Weston Lindemann.

2020, June. Arlinghaus, Sandra L., with William E. Arlinghaus and Weston Lindemann. Green Tables Section. “Eating ‘the Vine that Ate the South’: Turnabout is Fair Play.” *Les Dames d’Escoffier International. Quarterly.* Spring 2020, p. 28.

2019, December. *Solstice: An Electronic Journal of Geography and Mathematics.* Ann Arbor: Institute of Mathematical Geography, [Volume 30](#), Number 2. December 2019.

- “Introduction” to the Special Issue on Bonus Use.



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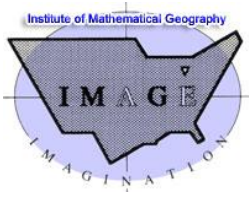
- “Kudzu Cascades: Bonus Use Leads to Economic Opportunity?” Sandra L. Arlinghaus, William E. Arlinghaus, and Weston Lindemann.

2018, December. *Solstice: An Electronic Journal of Geography and Mathematics*. Ann Arbor: Institute of Mathematical Geography, [Volume 29](#), Number 2. December 2018.

“Cascade: Observation and Challenge.”

Kudzu nutrition links:

- CDC Report: <https://www.cdc.gov/nutritionreport/pdf/Isoflavones.pdf>
- Healthline: <https://www.healthline.com/nutrition/kudzu-root>
- As fodder: <https://www.mdpi.com/2077-0472/9/10/220#:~:text=Corley%20et%20al.,for%20growing%20ruminants%20%5B20%5D.>
- Memorial Sloan Kettering Cancer Center: <https://www.mskcc.org/cancer-care/integrative-medicine/herbs/kudzu#:~:text=Kudzu%20is%20an%20herb%20used,anti%2Dinflammatory%20and%20neuroprotective%20properties> .



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Notes

Compact Communications

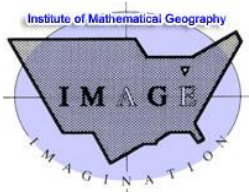
By their nature, both traditional globes and maps engage in the challenge of communicating large amounts of information using only a small, compact space. Numerous decisions must be made as to what to include, and perhaps even more important, what to exclude in order to optimize user comprehension and communication: compression.

This issue is not, however, unique to globes and to maps. Imagine designing a postage stamp—a tiny space in which the reader gets only a fleeting glimpse of the image as it passes through a postal network! Or consider the names on a trophy, often encased in a theft-proof housing, visible only as one walks past it. Links below offer some of our experience in dealing with these matters. We encourage the reader of *Solstice* to think about his/her own world and where compression of information, within a small physical space, might arise, and when it does, how to handle it to yield good transfer of information.

CartoPhilatelist

In addition to these specific links, please browse the many fine articles by others. Miklos Pinther does an outstanding job of guiding the reader through this beautiful journal.

- "[Pneumatic Postal Maps: The French Connections](#)." The *CartoPhilatelist*, Vol. 38, No. 3, September 1993. The CartoPhilatelic Society. pp 71-75.
- "[The Ends of the Earth](#)." The *CartoPhilatelist*, Vol. 39, No. 1, March 1994. The CartoPhilatelic Society. pp. 11-14.
- "[The Berlin Rohrpost](#)." The *CartoPhilatelist*, Vol. 40, No. 1, March 1995. The CartoPhilatelic Society. pp. 24-25.



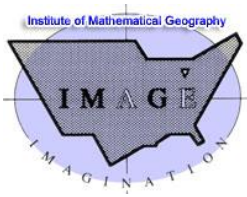
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Bridge Trophies

Look at the very different shapes of these trophies; imagine differing difficulties in inscribing them effectively. Notice the plinths added as billboards for names as space on the central cup began to shrink.



Legacy Michigan Bridge Association trophies; Bill sits in the background from a time when he was trophy master for the Unit. Read more: [link to Monograph 28](#) in the next section.



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New Monographs

News from IMaGe. Four new monographs are now archived on the Deep Blue IMaGe site.

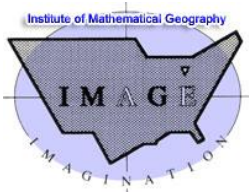
- Monograph Twenty Six, Sandra L. Arlinghaus, William C. Arlinghaus, Ronald M. Horwitz, 2023. Direct link to document, [Event Planning Using Spatial and Temporal Master Plans: A Detroit Case Study](#). [Link](#) to page containing document and associated supplementary files.
- Monograph Twenty-Seven. Sandra L. Arlinghaus with input from Aileen Osofsky, Sandra DeMartino, William C. Arlinghaus, and others as noted throughout the text, 2023. Direct link to document, [Goodwill Planning: A Personal Perspective on the American Contract Bridge League's Aileen Osofsky Goodwill Committee](#) . [Link](#) to page containing document and associated supplementary files.
- Monograph 28. William C. Arlinghaus. Direct link to document, [Bridge Planning: As an Administrator and As a Player](#). [Link](#) to a page containing document and associated supplementary files.
- Monograph 29. Sandra L. Arlinghaus, writing as B. K. Barry. [Mysteries, Bridge, and a Culinary Twist](#). A work of fiction displaying how academic approaches might enter a variety of situations in one's life.

Interesting Links

The following links might be of interest to readers with particular interest:

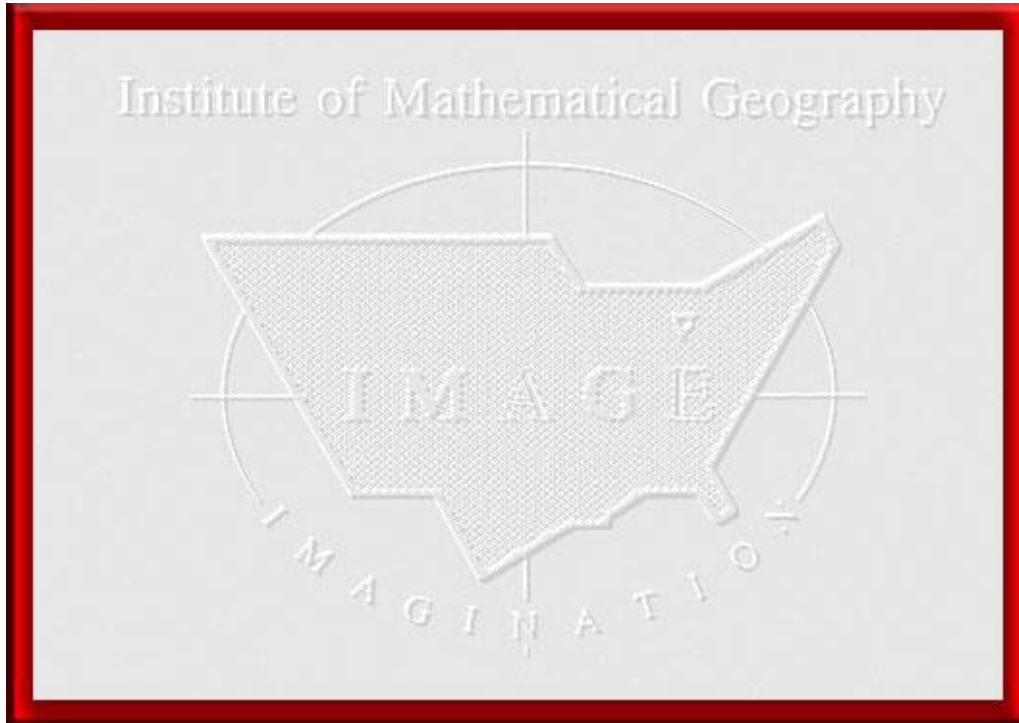
- Feeding seaweed to cows can cut methane emissions. *The Guardian*. October 2023. [Link](#).
- *A Survey of Graphs of Minimum Order with Given Automorphism Group*. Jessica Alyse Woodruff, Master's Thesis, University of Texas at Tyler. 2016. [Link](#).
- An early occurrence of World Food Systems, from a listing in *The University of Michigan LSA Catalogue* from 1974, Department of Geography.

Geography 432, Nystuen, "Agricultural location theory, human adjustment to uncertainty in the environment, aspects of world food allocation on nutrition, ecological and social problems of modern agriculture." [Link](#).



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Endmatter



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

AWARDS AND SELECTED COMMENTS

Solstice page translated into Belorussian, April, 2016; many thanks to Valerie Bastiaan.

Solstice cover materials translated into Ukranian, August 25, 2011; many thanks to Galina Miklosic.

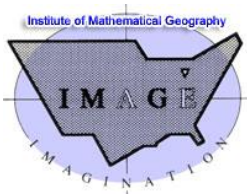
Solstice was a Pirelli INTERNETional Award Semi-Finalist, 2001 (top 80 out of over 1000 entries worldwide)

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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🌐 LISTINGS IN DIRECTORIES AND DATABASES

IMaGe is listed as a "Collection" in the persistent online archive, [DeepBlue](#), of The University of Michigan library. It is listed under "Mathematical Geography" on the Collections link.

Solstice has been listed in the Directory of Open Access Journals (for its first 28 years) maintained by the University of Lund.

Solstice is listed on the journals section of the website of the American Mathematical Society, <http://www.ams.org/>

Solstice has been listed in the EBSCO database.

IMaGe has been listed on the website of the Numerical Cartography Lab of The Ohio State University, with thanks to Harold Moellering.

Solstice was listed in Geoscience e-Journals, with thanks to Bruno Granier.



Sandra L. Arlinghaus, celebrated over 30 full years of archived *Solstice* publication in 2020.