

Valuing The Subsistence Use of Goods and Services in Louisiana Coastal Communities: Using Emergy to Analyze Non-Market Activity

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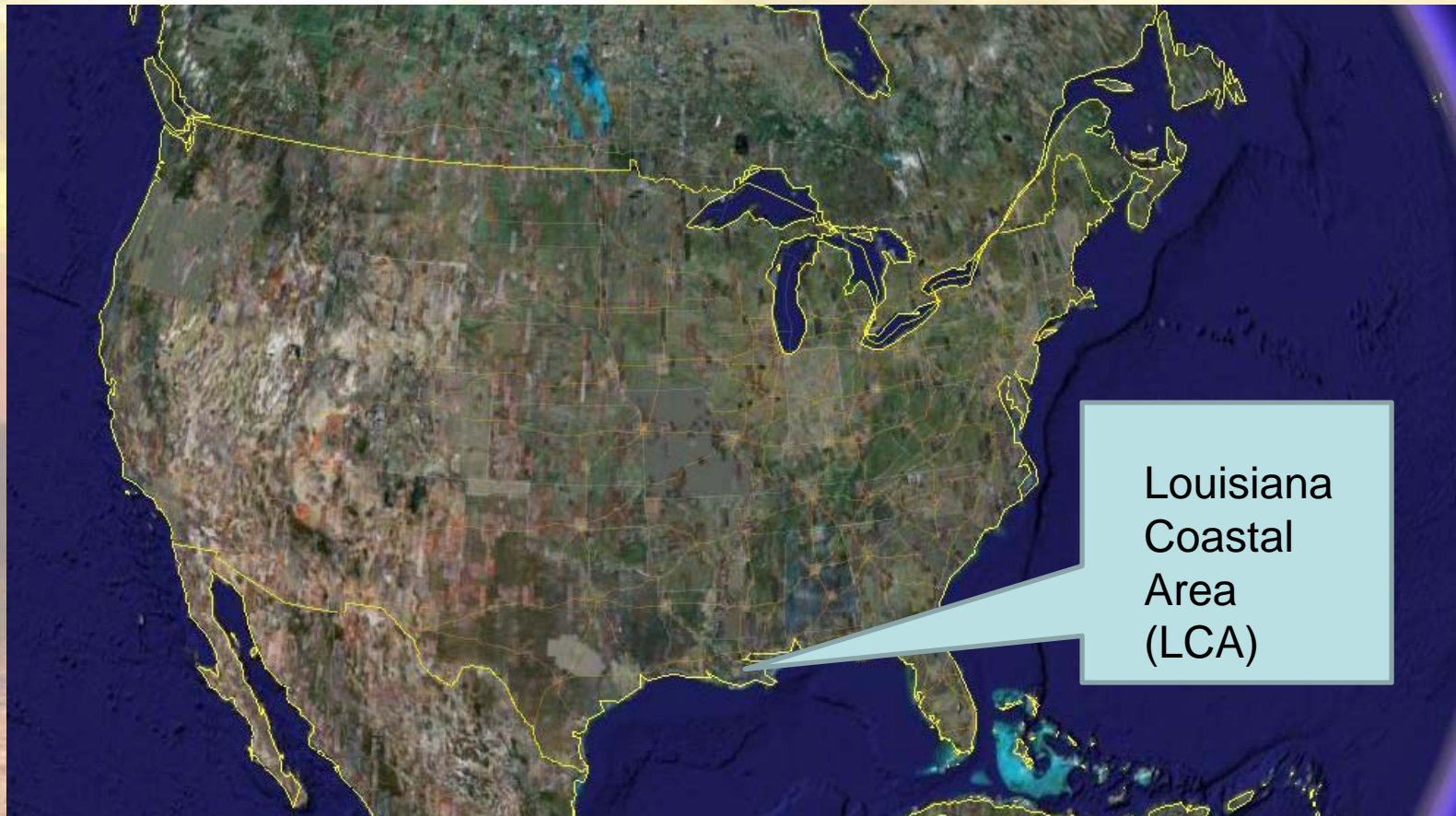
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Gainesville, Florida



Project Location



Louisiana
Coastal
Area
(LCA)

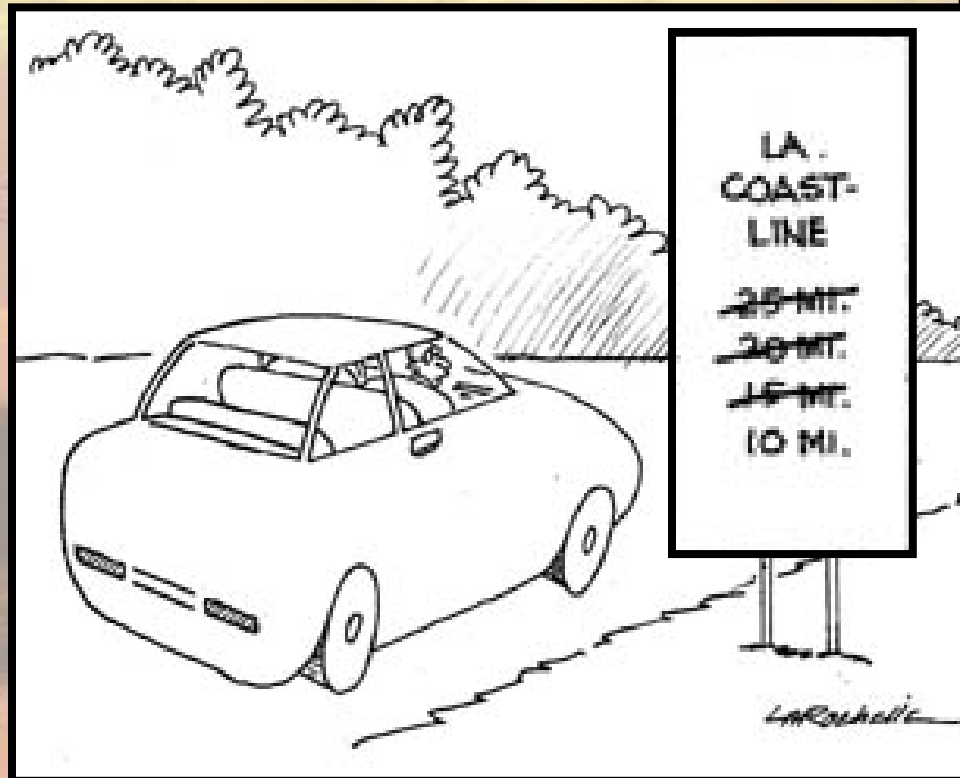
Subsistence:

Sharing, Distribution, and Exchange of Resources among Households in Coastal Communities



Emergy and Subsistence Economics

- Why?
- Economies of the coastline
- Existing Methodology ignores many non-market aspects of the system.
- Supplemental Methodology
 - Estimate an initial LCA BCR
 - Justification of \$14-B Investment
 - Sustainability Assessment
- Applications



Maurice LaRochelle, Baton Rouge Advocate Nov. 6th 2003

What's at Stake?

- **Costs**

- **Replacement of Eco-services**
 - Fisheries
 - Nursery habitat
- **Cost of Infrastructure**
 - Levees
 - Diversions
 - structures
- **Relocation and Associated Costs**
 - Housing
 - jobs
 - cultural Losses

- **Benefits**

- **Restoration/preservation of Eco-services**
- **Protection of infrastructure**
- **Preservation of communities**



Combined Conventional Economic Models & Environmental Accounting

Tangible Assets:

- Industry, infrastructure & commerce
- Resultant revenue preserved
- Savings in projected infrastructure maintenance costs
- Avoided costs in maintenance of individual property insurance rates and underwriting costs



NATURAL and CULTURAL Asset Evaluation:

Intangible Assets:

- **Natural assets of the coastal wetlands**
- **Sustaining properties from Mississippi River (sediment, nutrients & freshwater)**
- **Assimilative properties & mitigating services provided by the coastal environment**
- **Non-market commodities**
- **Cultural resources**



Unrecognized Coastal Economies?

- **Have we underestimated the value of non-market coastal resources?**
- **What is the range of coastal subsistence activities?**
- **How important (valuable) are these activities?**

Exchange in Subsistence Economy

- **General Reciprocity**
 - Family Support (nuclear & extended family)
 - Giving for Charity (community, church, club)
- **Balanced Reciprocity**
 - Exchanging Material or Services of Equal Value
 - Repay is often Deferred
 - Useful in Maintaining Alliances
- **Trade/Barter – Exchange of Specified Items**
- **Redistribution of Goods (usually to earn prestige)**

Gardens Deserve A Closer Look

- 2005 La. Ag Summary -- 6,500 home gardens in Lafourche Parish
- What are they growing?
- How important are gardens?
- Who gets the produce?



Loulan Pitre, Cuttuff



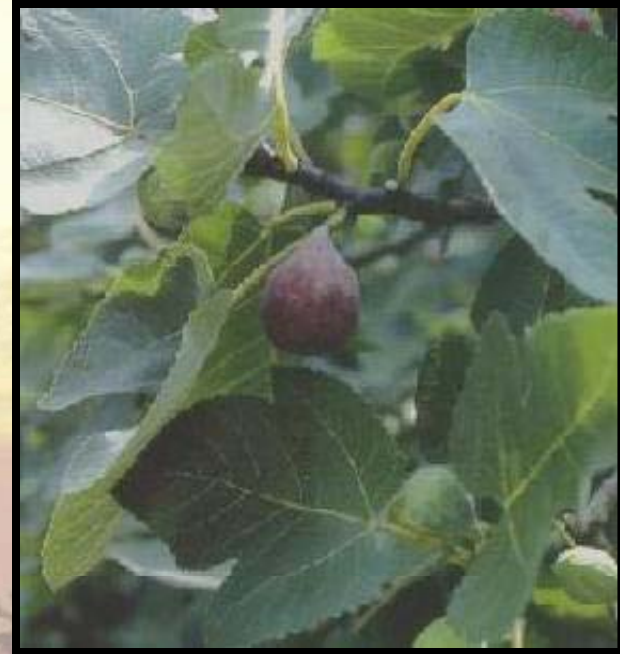
Hibiscus esculentus
Gumbo
Okra

Not for Sale in
Grocery
Stores !



Ficus carica (Fig)

- 2005 La. Ag. Summary -- only 3 acres of figs in Lafourche Parish
- They are ubiquitous!
- Locals claim they're needed.
- What do they do with them?
- Who gets them?



Prestige or Sustenance?



Survey of 45 Species/Resources

Shrimp	Catfish	Frogs	Garden Vegetables
Blue Crab	Crayfish	Deer	Chickens/Eggs (Yard)
Oyster	Bream	Rabbit	Goat
Redfish	Sacalait	Squirrel	Satsuma
Speckled Trout	Choupique	Blackberry/Dewberry	Pears
White Trout	Gar	Soco (Muscadine)	Figs
Black Drum	Alligator	Roseau Cane	Persimmon
Sheep Head	Turtles	Palmetto	Loquat (Jap. Plum)
Flounder	Ducks	Horsetail	Sassafras (filé)
Croaker	Geese	Black Gum	Medicinal Plants
Mullet	Poule d'eau (coot)	Cypress	Other?
Other Saltwater Species			

Household Use of Species/Resources

How often do you eat or use it?

- More than once a week
- Weekly
- Monthly
- Seldom

How do you get it? Check all that apply

- Catch, harvest
- Given to you
- Trade
- Buy

Is this resources necessary to you?

- Yes
- No

What do you do with this resource? [Check all that apply]

- Eat or consume
- Give away
- Trade
- Sell

Since the Hurrricanes, has your use of this resource changed?

Consumption / Exchange Patterns

Species	Eat or Consume	Give away	Trade	Sell	> Monthly
Shrimp	91%	10%	4%	6%	89%
Crayfish	78%	3%	0%	1%	54%
Redfish	76%	24%	1%	0%	49%
Garden Vegetables	73%	11%	2%	1%	67%
Speckled Trout	72%	23%	1%	0%	56%
Blue Crab	67%	9%	2%	2%	58%
Oyster	66%	7%	2%	0%	47%
Flounder	64%	8%	1%	1%	30%
Satsuma	61%	8%	0%	1%	41%
Catfish	57%	6%	1%	2%	41%
Deer	57%	9%	1%	0%	28%
Figs	48%	9%	0%	1%	26%
Chickens/Eggs	47%	3%	0%	1%	40%
Blackberry/Dewberry	46%	8%	0%	1%	22%

Consumption / Exchange Patterns, cont.

<u>Species</u>	<u>Eat/Consume</u>	<u>Give Away</u>	<u>Trade</u>	<u>Sell</u>	<u>> Monthly</u>
Ducks	42%	8%	1%	0%	17%
White Trout	40%	13%	1%	0%	17%
Pears	38%	3%	0%	0%	24%
Rabbit	37%	5%	1%	0%	12%
Sassafras (file)	32%	4%	0%	0%	24%
Frogs	32%	4%	0%	0%	9%
Black Drum	29%	11%	1%	1%	13%
Alligator	27%	3%	1%	0%	3%
Loquat (Japanese Plum)	24%	7%	0%	0%	9%
Sacalait	23%	5%	0%	1%	10%
Sheep Head	22%	12%	1%	1%	11%
Poule d'eau (coot)	21%	4%	0%	0%	4%
Persimmon	21%	4%	0%	0%	11%
Turtles	20%	3%	0%	0%	4%



Amia calva

***choupique*, bowfin, grinnel,
cypress trout, dogfish**

**Choupique catches, Adams Fruit
Market, Mathews, Louisiana**





American Coot

Michael A. Seymour

Fulica americana
Poule d'eau
Coot

Poule d'eau Gumbo

Skin *poule d'eau*, wash, cut up, salt and pepper;

Fry lightly and set aside;

Make basic roux



Lafourche *poule d'eau* decoys

How Respondents Obtained Species

<u>Species</u>	<u>Catch/Harvest</u>	<u>Given to You</u>	<u>Buy</u>	<u>Trade</u>
Speckled Trout	56%	41%	7%	6%
Redfish	54%	47%	6%	1%
Flounder	38%	40%	10%	1%
Blackberry/Dewberry	34%	16%	8%	3%
White Trout	32%	21%	1%	1%
Blue Crab	28%	32%	52%	2%
Shrimp	27%	41%	66%	2%
Figs	26%	28%	7%	2%
Black Drum	25%	15%	1%	2%
Garden Vegetables	24%	34%	52%	1%
Sheep Head	21%	14%	1%	1%
Satsuma	21%	29%	38%	1%
Ducks	19%	34%	4%	1%
Catfish	18%	21%	38%	1%

How Respondents Obtained Species, cont.

<u>Species</u>	<u>Catch/Harvest</u>	<u>Given to You</u>	<u>Buy</u>	<u>Trade</u>
Deer	16%	52%	3%	1%
Rabbit	16%	27%	3%	1%
Sacalait	15%	14%	1%	1%
Loquat (Japanese Plum)	12%	12%	4%	1%
Crayfish	12%	22%	72%	0%
Oyster	11%	26%	54%	1%
Frogs	10%	21%	12%	1%
Persimmon	8%	10%	7%	1%
Poule d'eau (coot)	7%	18%	2%	1%
Turtles	6%	17%	3%	0%
Pears	6%	13%	28%	1%
Chickens/Eggs (Yard)	5%	16%	37%	2%
Sassafras (file)	2%	10%	25%	1%
Alligator	2%	21%	7%	0%

Are They Economically Significant ?

Very Likely

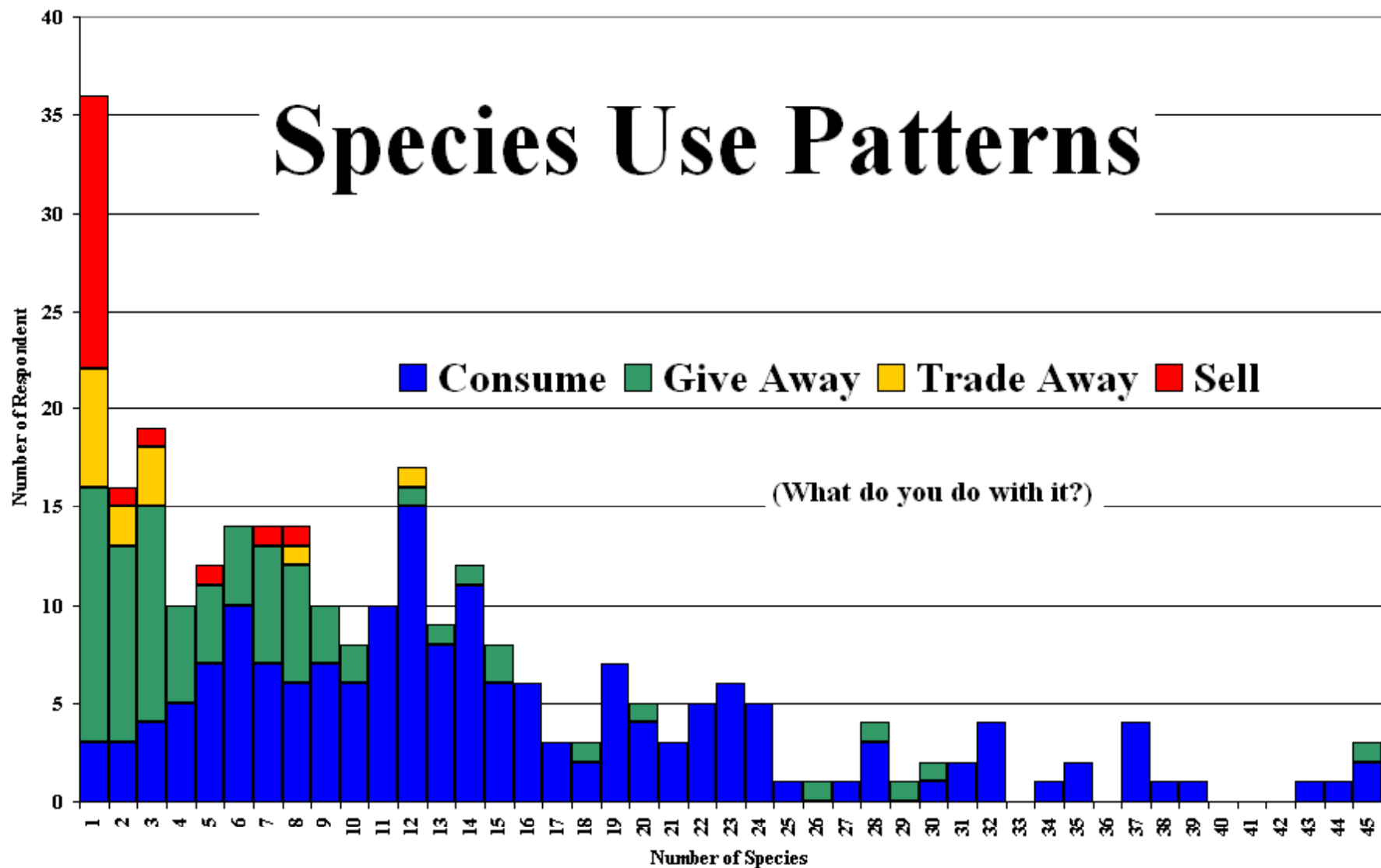


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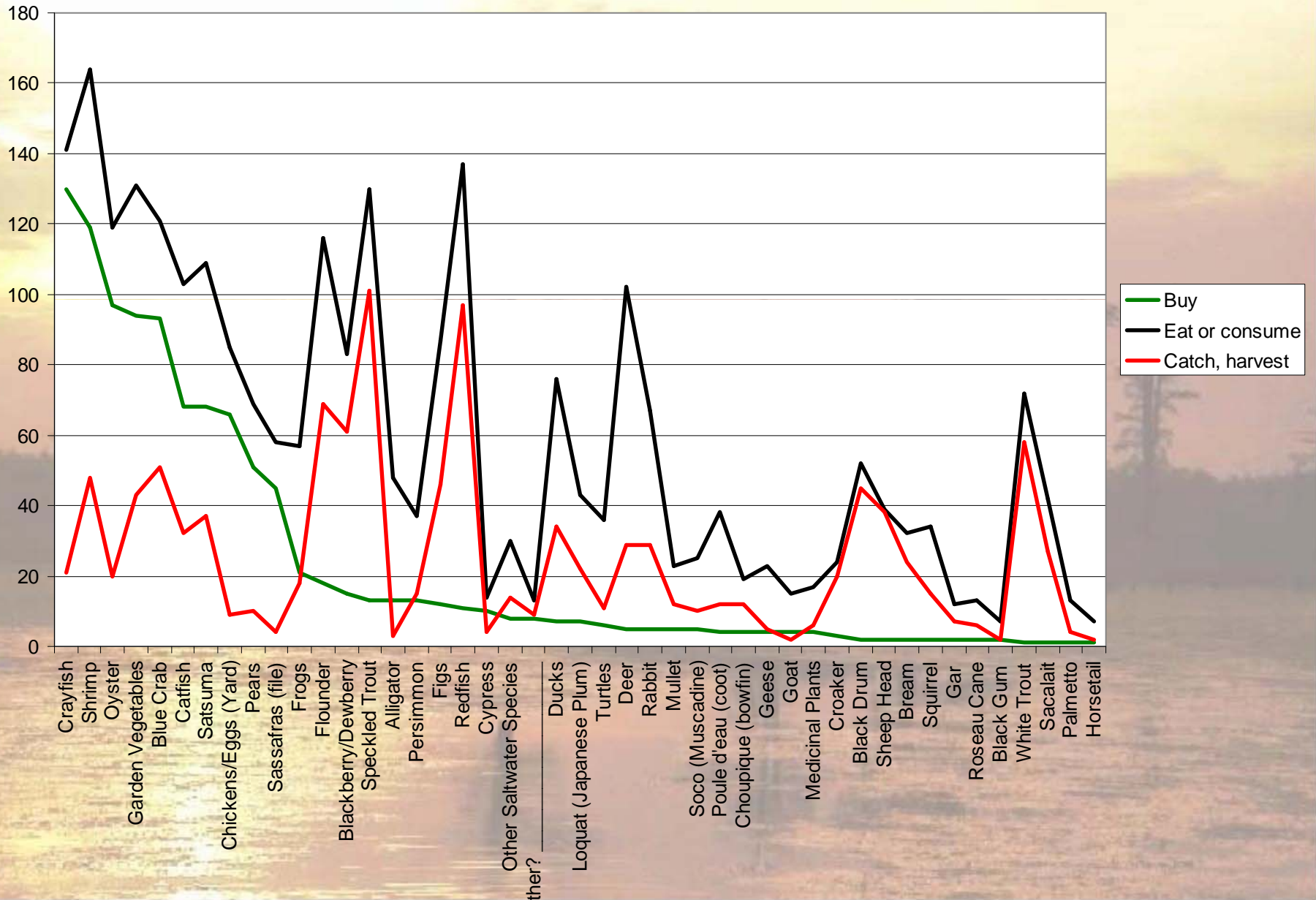
- Redfish
- Speckled Trout
- Shrimp
- Blue Crab
- Crawfish
- Oysters
- Catfish
- Garden Vegetables

- Figs
- Choupique
- Sacalait
- Poule d'eau
- Soco
- Horsetail
- Loquat
- Medicinal Plants

Species Use Patterns



Profile of a Subsistence Economy



Why is Subsistence Econ Important ?

- **Linked to Resilience**
- **Quality of Life Factors**
- **Part of Traditional Heritage**
- **Cultural Identity and Distinctiveness**



How is this System Sustained?

- **Depends on Biological Diversity**
- **Requires Traditional Knowledge --**
(Largely transmitted in French)
- **Social Stability is Needed**
 - **Stable Social Networks**
 - **Stable Patterns of Reciprocity**

Table 1: Emergy Evaluation of Garden Vegetables, per ha per year

Note	Item	Unit	Data (units/yr)	Unit Solar EMERGY (sej/unit)	Solar EMERGY (E13 sej/yr)	Em\$ Value (Y 2000)
RENEWABLE RESOURCES						
1	Sun	J	3.81E+13	1	4	19
2	Rain (geopotential)	J	7.40E+08	3.02E+04	2	11
3	Et	J	5.85E+10	2.59E+04	151	758
NONRENEWABLE STORAGES						
4	Net Topsoil Loss	J	7.69E+09	1.24E+05	95	433
	<i>Sum of free inputs (sun, rain omitted)</i>				247	1191
LABOR						
5	Labor (renewable)	J	4.52E+08	4.45E+06	201	1006
PURCHASED INPUTS						
Operational inputs						
6	Fuel	J	0.00E+00	1.11E+05	0	0
7	Electricity	J	0.00E+00	2.69E+05	0	0
8	Potash	g K	3.28E+04	1.85E+09	6	30
9	Lime	g	5.81E+04	1.68E+09	10	49
10	Pesticides	g	0.00E+00	2.52E+10	0	0
11	Phosphate	g P	9.28E+03	3.70E+10	34	172
12	Nitrogen	g N	8.38E+03	4.05E+10	34	170
13	Services	\$	2.61E+03	2.00E+12	522	2612
	<i>Sum of purchased inputs</i>				606	3033
	<i>Total Emergy</i>				853	
TRANSFORMITIES, Calculated						
14	Total Yield, dry weight	g	3.30E+06	2.59E+09 sej/g		
15	With services	J	6.42E+10	1.33E+05 sej/J		
16	With out services	J		5.15E+04 sej/J		

Table 1: Emergy Evaluation of Garden Vegetables, per ha per year

INDICES, calculated

Note	Name of Index	Expression	Quantity
17	Investment Ratio	$(P + S)/(N + R)$	2.46
18	Yield Ratio	$Y/(P + S)$	1.41
20	Nonrenewable/Renewable	$(N + P)/R$	2.51
21	Empower Density	sej/ha/yr	8.53E+15

Table 2: Emergy Evaluation of Figs in Coastal Louisiana, per ha per year

Note	Item	Unit	Data (units/yr)	Unit Solar EMERGY (sej/unit)	Solar EMERGY (E13 sej/yr)	Em\$ Value
RENEWABLE RESOURCES						
1	Sun	J	3.81E+13	1	4	17
2	Rain (geopotential)	J	7.40E+08	3.02E+04	2	10
3	Et	J	6.51E+10	2.59E+04	168	731
NONRENEWABLE STORAGES						
4	Net Topsoil Loss	J	6.33E+08	1.24E+05	8	36
	<i>Sum of free inputs (sun, rain omitted)</i>				176	767
LABOR (Renewable)						
5	Labor	J	5.17E+07	4.45E+06	23	100
PURCHASED INPUTS						
Operational inputs						
6	Fuel	J	0.00E+00	1.11E+05	0	0
7	Electricity	J	0.00E+00	2.69E+05	0	0
8	Potash	g K	0.00E+00	1.85E+09	0	0
9	Lime	g	0.00E+00	1.68E+09	0	0
10	Pesticides	g	0.00E+00	2.52E+10	0	0
11	Phosphate	g P	0.00E+00	3.70E+10	0	0
12	Nitrogen	g N	7.13E+03	4.05E+10	29	125
13	Services	\$	2.29E+03	2.30E+12	527	2290
	<i>Sum of purchased inputs</i>				556	2415
	<i>Total Emergy</i>				755	
TRANSFORMITIES, Calculated						
14	Total Yield, dry weight	g	3.72E+05	2.03E+10 sej/g		
15		J	3.86E+09	1.96E+06 sej/J		
16	With out services			5.91E+05 sej/J		

Table 2: Emergy Evaluation of Figs in Coastal Louisiana, per ha per year (cont.)

INDICES, calculated

Note	Name of Index	Expression	Quantity
16	Investment Ratio	$(P + S)/(N + R)$	2.79
17	Yield Ratio	$Y/(P + S)$	1.36
20	Nonrenewable/Renewable	$(N + P)/R$	0.35
21	Empower Density	sej/ha/yr	7.55E+15

Table 3. Emergy Evaluation of Subsistence Production Coastal Louisiana, per acre per year

Note	Item	Data (units/yr)	Unit	Unit Solar Emergy (sej/unit)	Solar Emergy (E13 sej/yr)	Em\$ Value, 2000* (\$/yr)
RENEWABLE INPUTS						
1	Sunlight	1.54E+13	J	1	2	8
2	Rain (chemical potential)	3.02E+10	J	2.59E+04	78	391
3	Rain (geopotential)	2.99E+08	J	3.05E+04	1	5
4	Wind (kinetic energy)	1.59E+09	J	2.45E+03	0.4	2
NON-RENEWABLE STORAGES USED						
5	Net Topsoil Loss	1.83E+07	J	1.24E+05	0.2	1
INDIGENOUS PRODUCTION						
6	Fishing	4.51E+08	J	3.36E+06	152	759
7	Hunting	1.19E+09	J	8.60E+05	102	510
8	Vegetable Gardens	6.43E+09	J	1.33E+05	85	427
9	Fruit orchards (figs)	7.24E+08	J	1.96E+06	142	709
	<i>Sum of Indigenous Production</i>				481	2405

Table 3. Emergy Evaluation of Subsistence Production Coastal Louisiana, per acre per year (cont.)

Note	Item	Data (units/yr)	Unit	Unit Solar Emergy (sej/unit)	Solar Emergy (E13 sej/yr)	Em\$ Value, 2000* (\$/yr)
PURCHASED INPUTS						
10	Natural Gas	1.65E+10	J	1.11E+05	182	913
11	Electricity	3.11E+09	J	2.69E+05	84	418
12	Water	1.81E+09	gal	3.00E+05	54	271
13	Food	2.51E+07	J	3.36E+06	8	42
14	Goods	3.50E+03	\$	2.00E+12	700	3500
15	Pesticides	0.00E+00	g	2.52E+10	0	0
16	Phosphate	9.28E+02	g P	3.70E+10	3	17
17	Nitrogen	1.61E+03	g N	4.05E+10	7	33
	<i>Sum of Purchased Inputs</i>				1038	5194
LABOR						
18	Hunting	1.57E+07	J	4.45E+06	7	35
19	Fishing	9.42E+07	J	4.45E+06	42	210
20	Vegetable production	1.57E+08	J	4.45E+06	70	349
21	Fruit production	2.09E+07	J	4.45E+06	9	47
	<i>Sum of Labor</i>				128	641

Table 3. Emergy Evaluation of Subsistence Production Coastal Louisiana, per acre per year (cont.)

Note	Item	Data (units/yr)	Unit	Unit Solar Emergy (sej/unit)	Solar Emergy (E13 sej/yr)	Em\$ Value, 2000* (\$/yr)
EXPORTS (Market)						
22	Labor	2.83E+08	J	4.45E+06	126	629
23	Fish	1.81E+08	J	3.36E+06	61	303
24	Meat (deer)	2.37E+08	J	8.60E+05	20	102
25	Vegetables	2.41E+09	J	1.33E+05	32	160
26	Fruits (figs)	2.72E+08	J	1.96E+06	53	266
	<i>Sum of Exports (market)</i>				292	1460
EXPORTS (Give aways)						
27	Fish	5.51E+07	J	3.36E+06	19	93
28	Meat (deer)	5.93E+07	J	8.60E+05	5	26
29	Vegetables	8.03E+08	J	1.33E+05	11	53
30	Fruits (figs)	9.05E+07	J	1.96E+06	18	89
	<i>Sum of Exports (give aways)</i>				52	260
	<i>Total Emergy</i>				1726	

Table 3. Emergy Evaluation of Subsistence Production Coastal Louisiana, per acre per year

INDICES, calculated

Note	Name of Index	Expression	Quantity
31	Emergy Investment Ratio	$(P + S)/(N + R)$	2.26
32	Emergy Yield Ratio (EYR)	$Y/(P + S)$	1.66
33	Nonrenewable/Renewable	$(N + P)/R$	0.74
34	Empower Density	sej/acre/yr	1.73E+16
35	Environmental Loading Ratio (ELR)	$(P + S + N)/R$	2.26
36	Emergy Sustainability Index -	EYR/ELR	0.74
37	Percent Renewables	$(R/R+P+S+N)$	0.44
38	Ratio of non-marketable/marketable goods		0.18
39	Ratio of non-marketable/purchased inputs		0.05
40	Fraction of non-marketable goods		0.03

* http://www.emergysystems.org/downloads/EXCEL_Spreadsheets/USA.xls

Comparisons

		Louisiana (this Study)			
Units		Vegetable Garden		Figs	
		w/ services	w/o services	w/ services	w/o services
transformity	sej/J	1.33E+05	5.15E+04	1.96E+06	5.91E+05
Total Energy	sej/ha/yr	8.53E+15		7.55E+15	

		Brazilian Soybeans (Ortega, et. al. 2001)			
		Ecological	Organic	Chemical	Herbicides
transformity	sej/J	8.81E+04	8.82E+04	1.04E+05	1.12E+05
Total Energy	sej/ha/yr	2.57E+15	2.39E+15	3.54E+15	3.80E+15

		Florida (Brandt-Williams, 2002)	Brazil (Jau) (Comar, 2004)	
		Oranges	Fruit Orchards	Manioc
transformity	sej/J	1.09E+05	4.00E+04	9.50E+04
Total Energy	sej/ha/yr	9.44E+15	2.45E+16	1.37E+15

		Mexico (Chiapas) (Diemont, et al., 2004)			
		traditional 1	traditional 2	Non-traditional 1	Non-traditional 2
transformity	sej/J	2.12E+06	2.04E+07	4.69E+06	1.05E+06
Total Energy	sej/ha/yr	2.44E+15	2.25E+15	2.25E+15	4.68E+15

		Arkansas (Brown & Vivas, 2006)	Mexico (Guillen Trujillo, 2002)	
		Corn	Corn (Shifting)	Corn (Chem)
transformity	sej/J	9.24E+04	3.64E+05	2.38E+05
Total Energy	sej/ha/yr	1.23E+16	1.82E+15	8.70E+15

Comparisons

		Louisiana (this Study)			
Units		Vegetable Garden		Figs	
		w/ services	w/o services	w/ services	w/o services
transformity	sej/J	1.33E+05	5.15E+04	1.96E+06	5.91E+05
Total Emergy	sej/ha/yr	8.53E+15		7.55E+15	

		Brazilian Soybeans (Ortega, et. al. 2001)			
		Ecological	Organic	Chemical	Herbicides
transformity	sej/J	8.81E+04	8.82E+04	1.04E+05	1.12E+05
Total Emergy	sej/ha/yr	2.57E+15	2.39E+15	3.54E+15	3.80E+15

Comparisons

		Florida (Brandt-Williams, 2002)	Brazil (Jau) (Comar, 2004)	
		Oranges	Fruit Orchards	Manioc
transformity	sej/J	1.09E+05	4.00E+04	9.50E+04
Total Energy	sej/ha/yr	9.44E+15	2.45E+16	1.37E+15

		Mexico (Chiapas) (Diemont, et al., 2004)			
		traditional 1	traditional 2	Non-traditional 1	Non-traditional 2
transformity	sej/J	2.12E+06	2.04E+07	4.69E+06	1.05E+06
Total Energy	sej/ha/yr	2.44E+15	2.25E+15	2.25E+15	4.68E+15

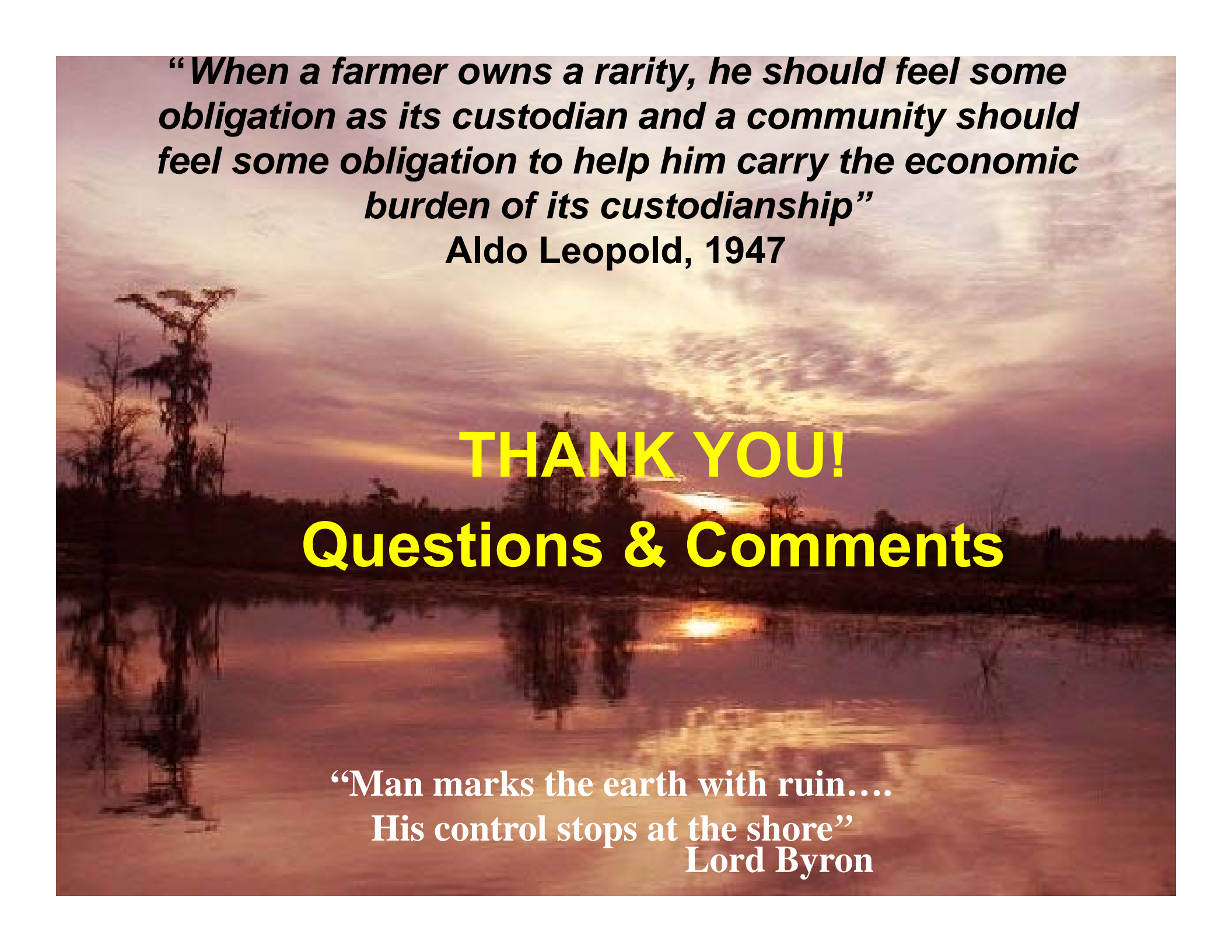
		Arkansas (Vivas & Brown, 2006)	Mexico (Guillen Trujillo, 2002)	
		Corn	Corn (Shifting)	Corn (Chem)
transformity	sej/J	9.24E+04	3.64E+05	2.38E+05
Total Energy	sej/ha/yr	1.23E+16	1.82E+15	8.70E+15

Comparisons

		Louisiana	Florida	Arkansas	Brazil (Eco)	Brazil (herb)	Mexico	Mexico	
Note	Name of Index	(this study)	(Brandt-Williams)	(Vivas & Brown)	(Ortega, et al.)	(Ortega, et al.)	(Guillen Trujillo, 2002)	(Guillen Trujillo, 2002)	
	Expression	Subsistence	Oranges	Corn	Soybean	Soybean	Corn(shifting)	Corn(chemical)	
31	Emergy Investment Ratio	$(P + S)/(N + R)$	2.26	4	1.99	1.09	3.25	0.74	5.68
32	Emergy Yield Ratio (EYR)	$Y/(P + S)$	1.66	1.23	1.5	1.92	1.31	7.89	1.53
33	Nonrenewable/Renewable	$(N + P)/R$	0.74	4	18.27	1.18	3.7	0.1	5.98
34	Empower Density	sej/acre/yr	1.73E+16	9.44E+15	1.18E+16	2.57E+15	3.80E+15	2.23E+16	8.75E+15
35	Environmental Loading Ratio (ELR)	$(P + S + N)/R$	2.26	4.46	15.28	1.19	3.7	0.87	8.14
36	Emergy Sustainability Index -	EYR/ELR	0.74	0.28	0.06	1.61	0.35	9.07	0.19
37	Percent Renewables	$(R/R+P+S+N)$	0.44						
38	Ratio of non-marketable/marketable goods		0.18						
39	Ratio of non-marketable/purchased inputs		0.05						
40	Fraction of non-marketable goods		0.03						

Summary

- Non-market items important in the economy of the south Louisiana communities and have measureable economic impact
- Emergy measures comparable to other low-intensity agricultural products
- Sustainability of these items, from a renewable-non-renewable perspective is better than most market agricultural items
- Additional Emergy comparisons will aid in evaluating non-market aspects of the Louisiana Coast



“When a farmer owns a rarity, he should feel some obligation as its custodian and a community should feel some obligation to help him carry the economic burden of its custodianship”

Aldo Leopold, 1947

THANK YOU!
Questions & Comments

**“Man marks the earth with ruin....
His control stops at the shore”
Lord Byron**