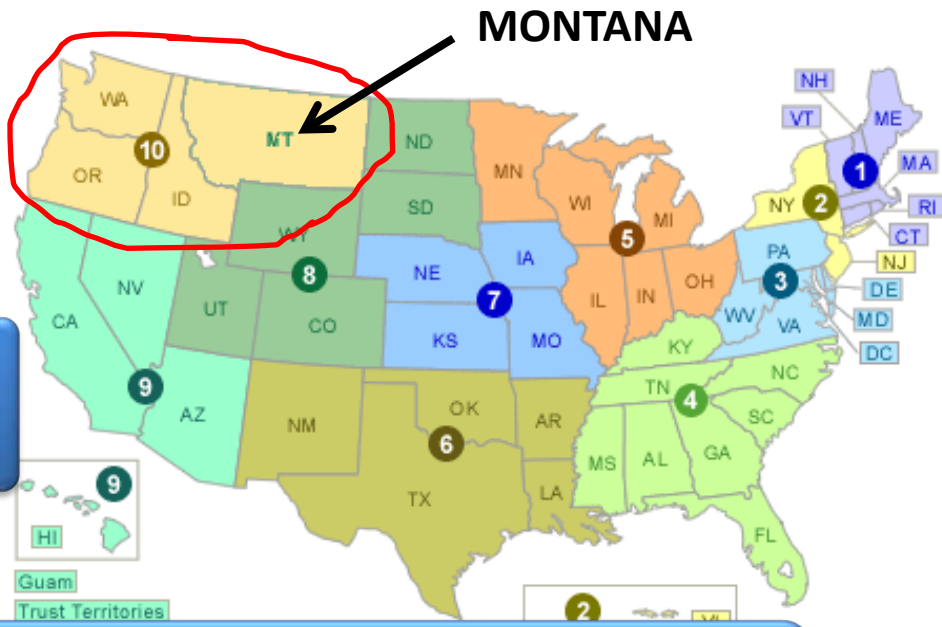


**Northwest (US) Advanced Renewables Alliance (NARA):**

## **An Innovative Approach to Identify Regional Bioenergy Infrastructure Sites**

Natalie Martinkus, Aditi Kulkarni,  
Nicholas Lovrich, **Paul Smith**,  
Wenping Shi, John Pierce, Michael  
Wolcott and Shane Brown

# I. Introduction



NARA Initiative:

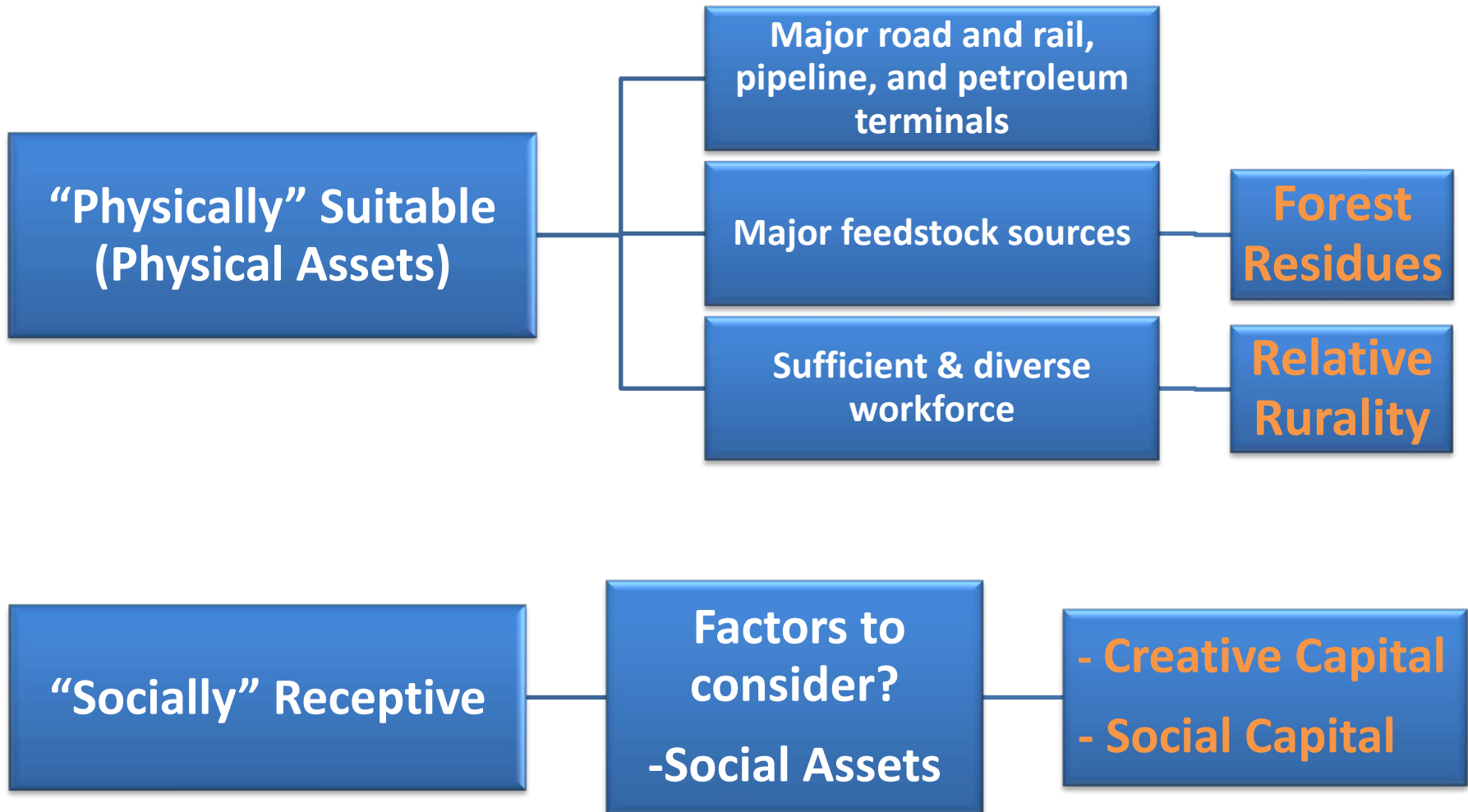


Develop socially acceptable & economically viable biofuel solutions for the U.S. Pacific Northwest (NARA Region)



Identify communities that are “physically” suitable & “socially” receptive to NARA Region biojet industry economic development

# I. Introduction



# Social Assets – Creative Capital

## Creative Capital

- **Predicts innovation, diversity and tolerance**; powers regional economic growth; (Florida 2003)
- Presence of arts-related aspects of local communities - **signals potential for economic development** (Florida 2002)

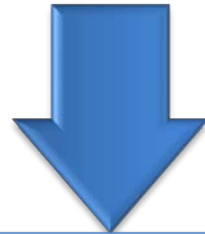
# Social Assets – **Social Capital**

## Social Capital

- Features of social life – **networks, norms & trust** – enables participants to act together more effectively for shared interests (Putnam; Fukuyama)
- Extensive **networks of voluntary associations** (Inglehart)

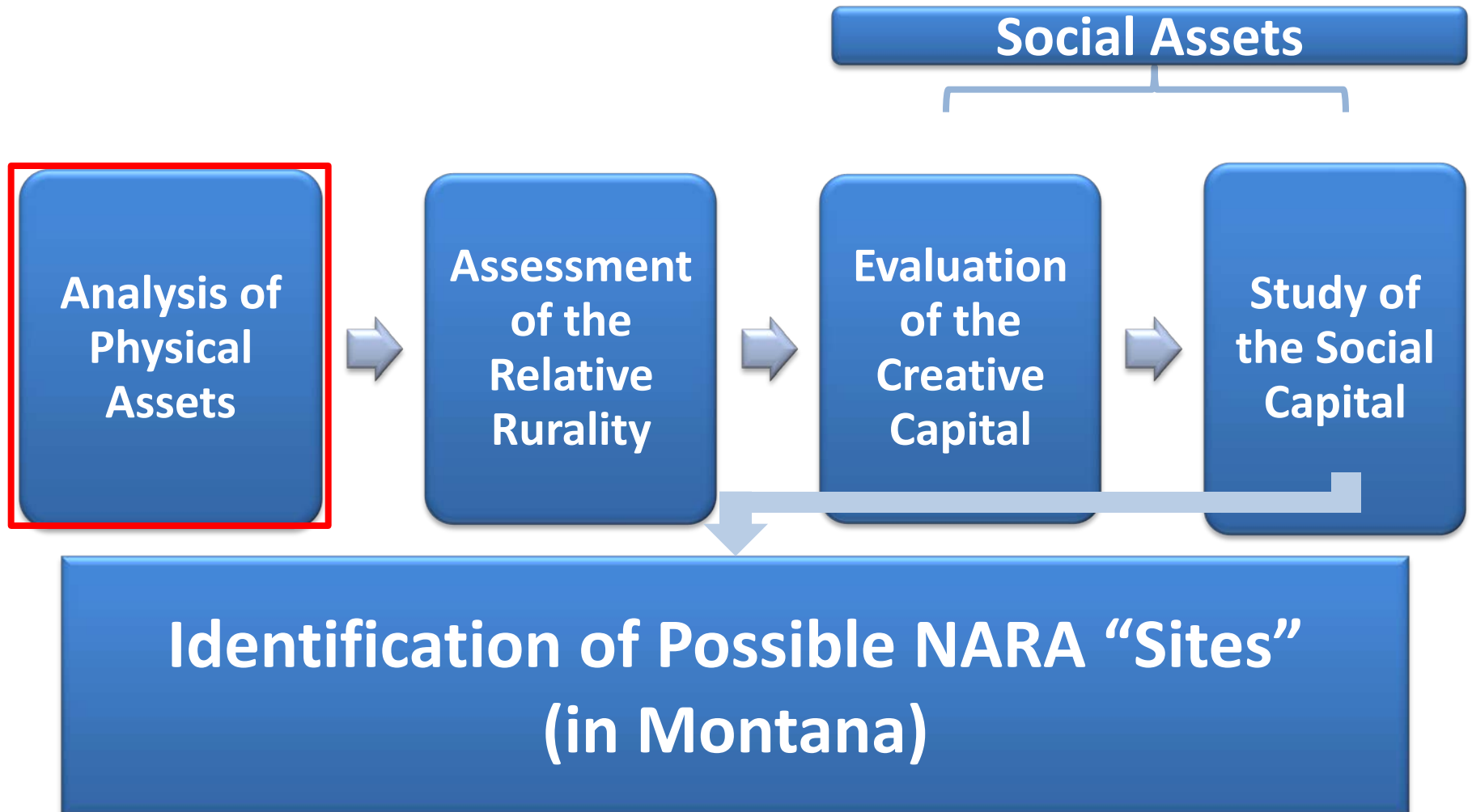
Communities with:

- High Creative Capital
- High Social Capital



May act collectively to exploit  
NARA Region opportunities  
(for biofuel production)

## II. Analysis – Roadmap (Montana)



# Physical Asset Analysis – GIS (MT)

## Physical Asset Assumptions:

1. Must have a population > 1,000
2. Located close to major road & rail network
3. Located near a pipeline terminal
4. Near large supply of woody biomass



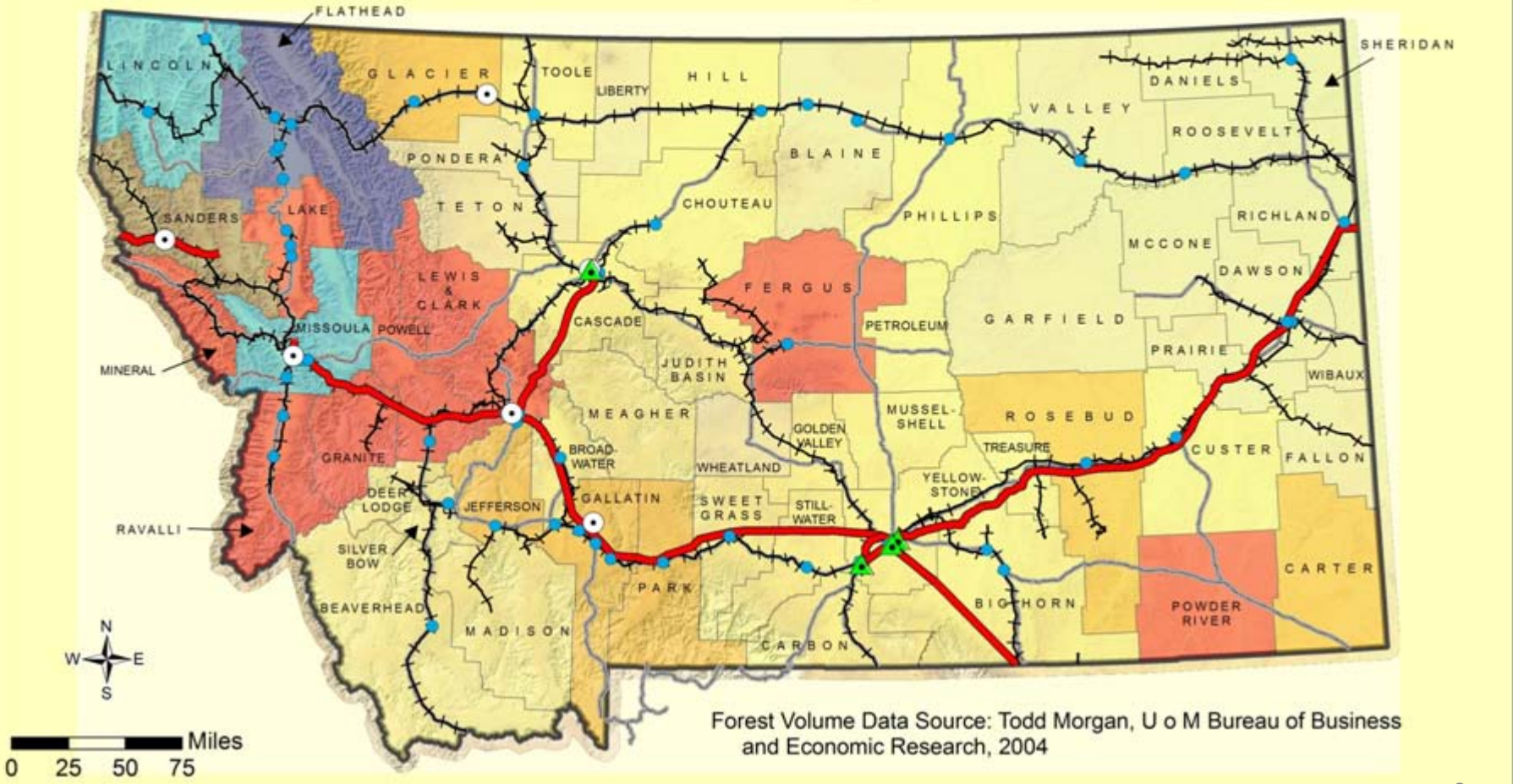
# Population, Roads/Rail, Pipelines, & Forest Residues

## Legend

- Towns with population > 1,000 on Road and Rail
- ▲ Petroleum Refinery
- Petroleum Pipeline Terminal
- Refined Products Pipeline
- + Railroads
- Interstates and Major Highways

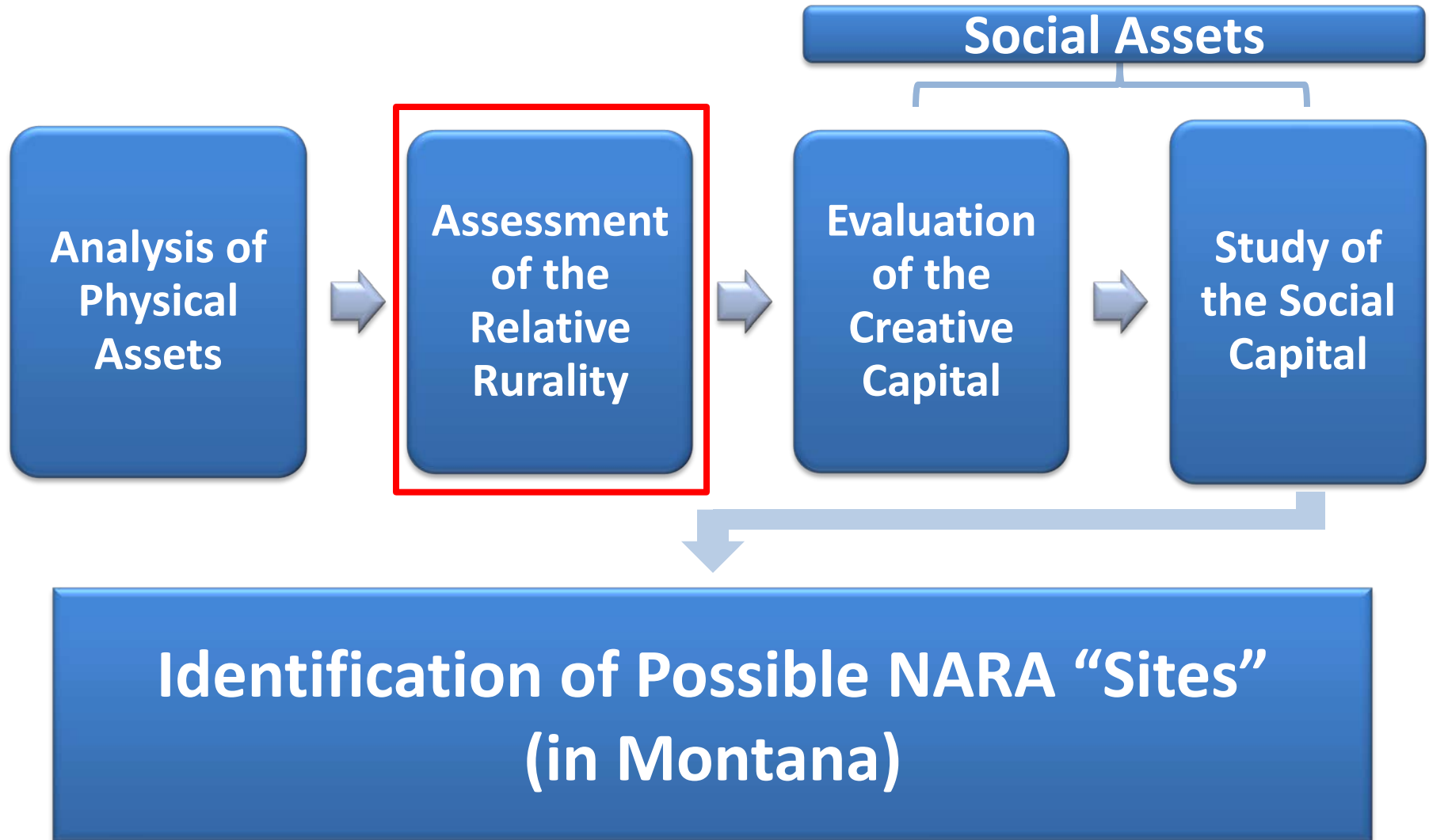
## 2004 Total Forest Volume (cu. ft.) from Logging, Logging Residue, and Mill Residue

- 0 - 869
- 869 - 500,000
- 500,000 - 1,000,000
- 1,000,000 - 4,000,000
- 4,000,000 - 7,000,000
- 7,000,000 - 10,000,000
- 10,000,000 - 11,722,800



Forest Volume Data Source: Todd Morgan, U o M Bureau of Business and Economic Research, 2004

## II. Analysis – Roadmap (Montana)



# Index for Relative Rurality (IRR)

- Estimates the **Degree of Rurality** for each county
- Based on: Population size, Density, Percentage of urban residents, and Distance to the closest metropolitan area
- Effect of change in **policy, environmental and/or cultural factors** on the change in **prosperity**

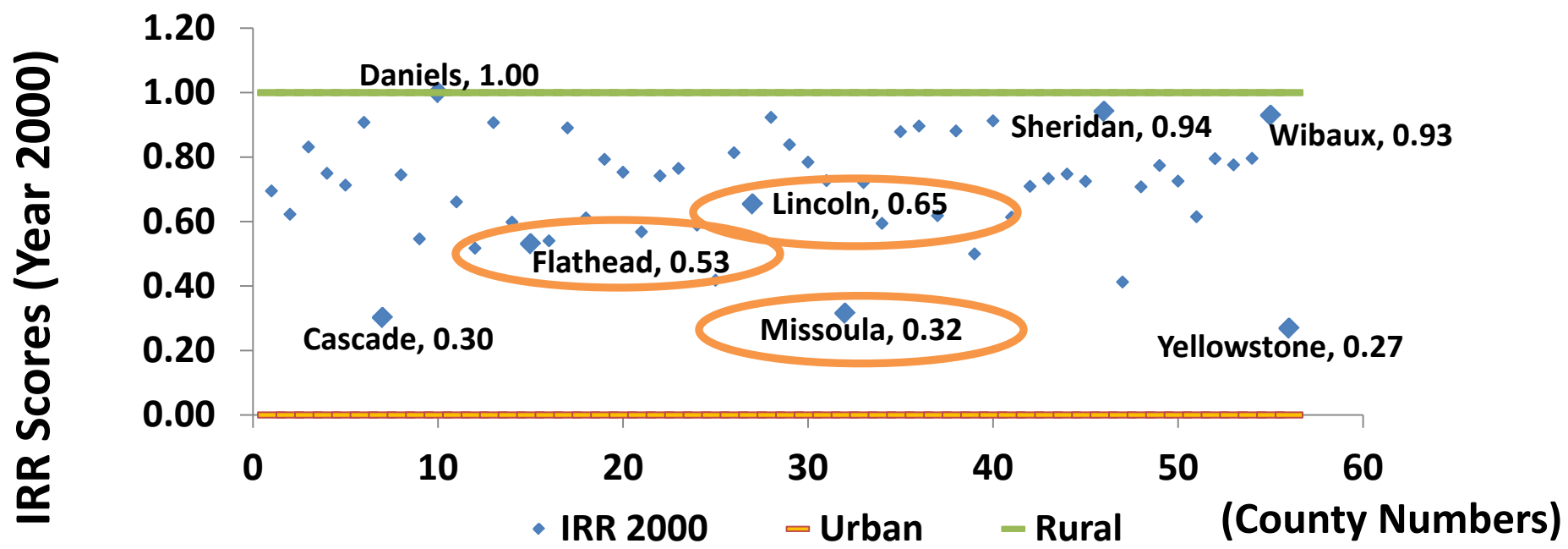


Figure 1. Scatter plot of IRR Score for Montana Counties (2000)

# High Forest Residues & Low IRR Values

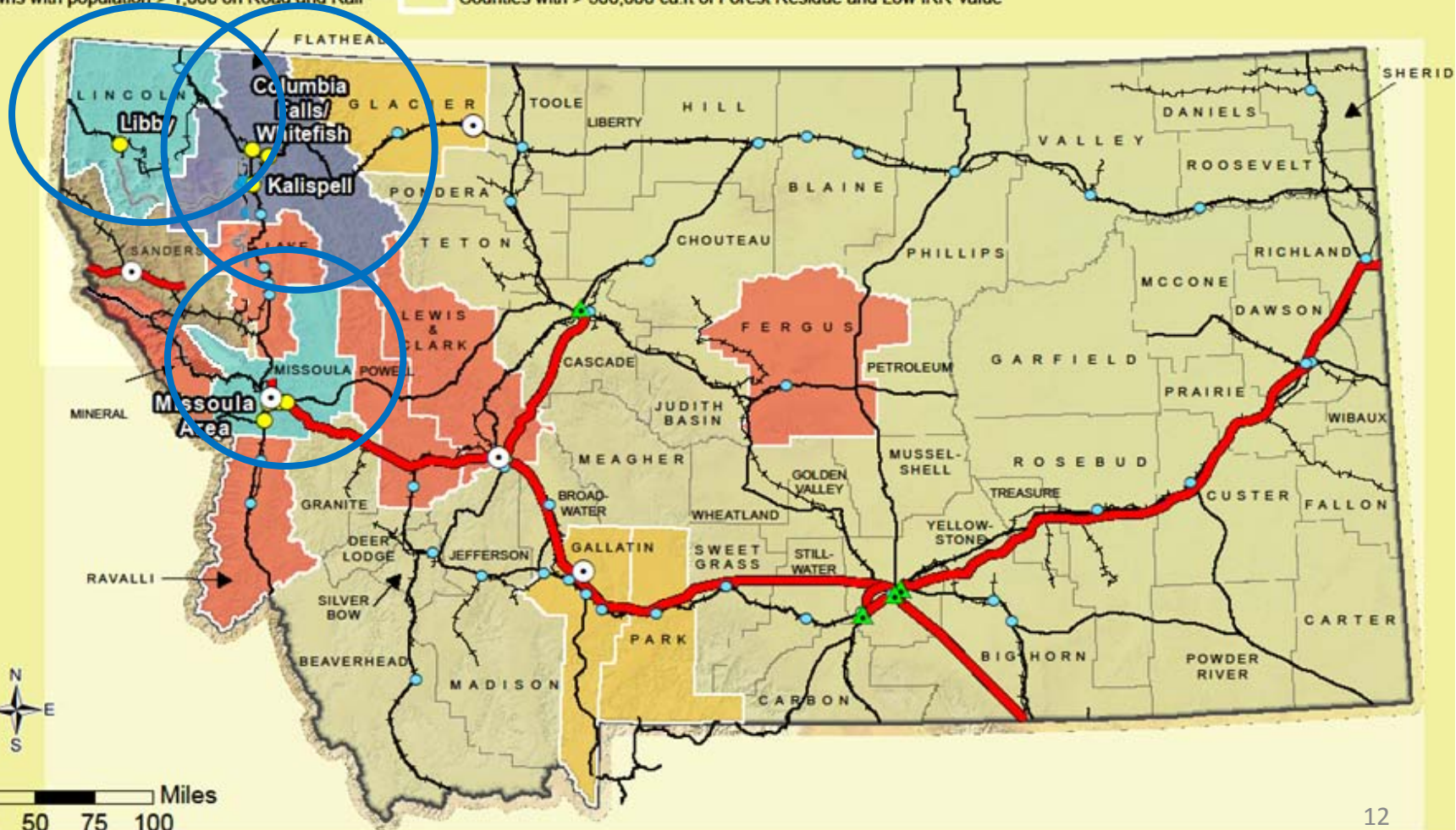
## Legend

- ▲ Petroleum Refinery (4 total)
- Petroleum Pipeline Terminal (5 total)
- Selected Cities from Physical Analysis
- Towns with population > 1,000 on Road and Rail

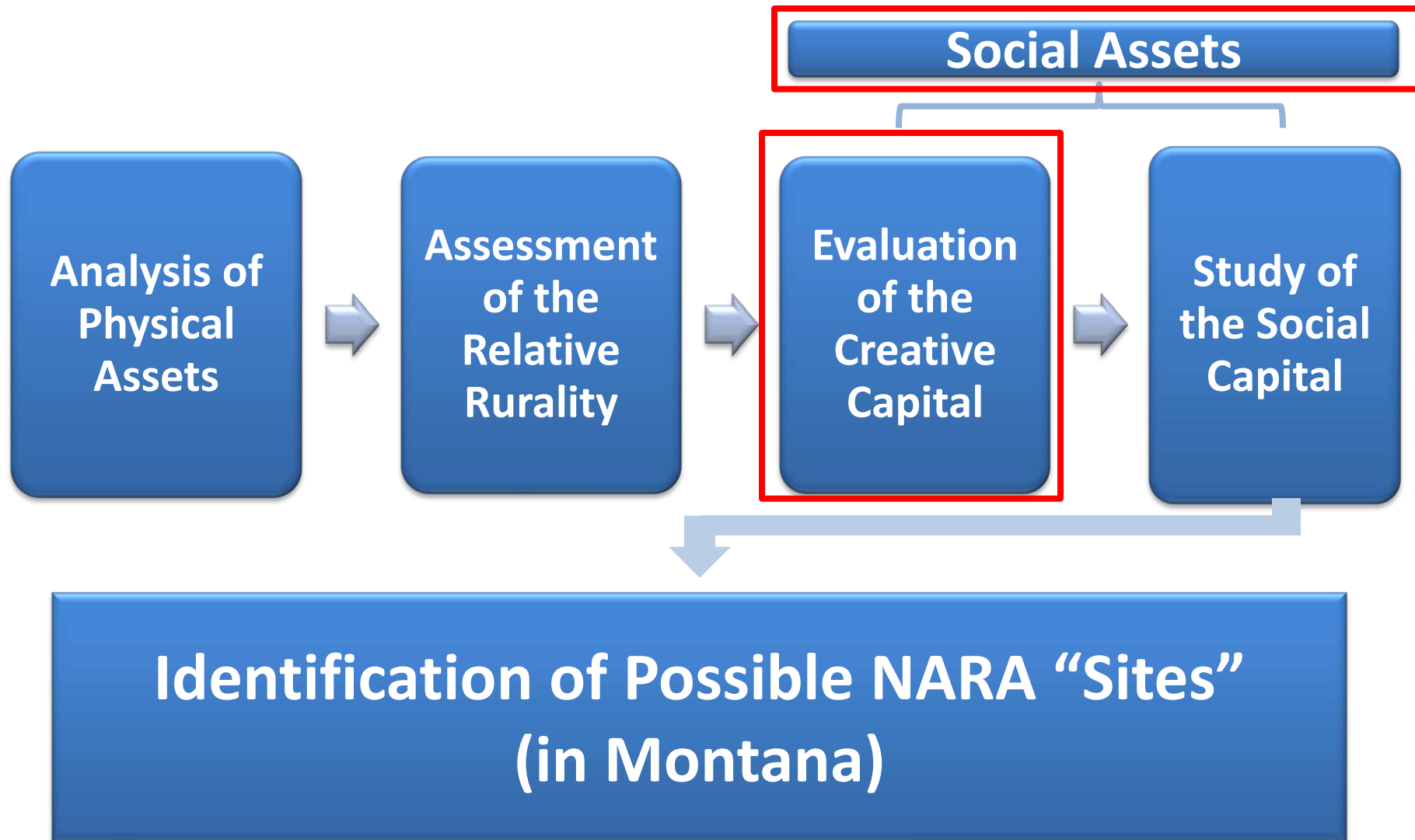
- Refined Products Pipeline
- +—+—+— Railroads
- Interstates and Major Highways
- Counties with > 500,000 cu.ft of Forest Residue and Low IRR Value

## 2004 Total Forest Volume (cu. ft.) from Logging, Logging Residue, and Mill Residue

0 - 500,000	4,000,000.1 - 7,000,000
500,000.1 - 1,000,000	7,000,000.1 - 10,000,000
1,000,000.1 - 4,000,000	10,000,000.1 - 11,722,800



## II. Analysis – Roadmap (Montana)



# Creative Capital - Creative Vitality Index (CVI)

- Health of a region's creative economy
  1. The national score = 1.0
  2. Arts-related Participation : Employment = 3:2

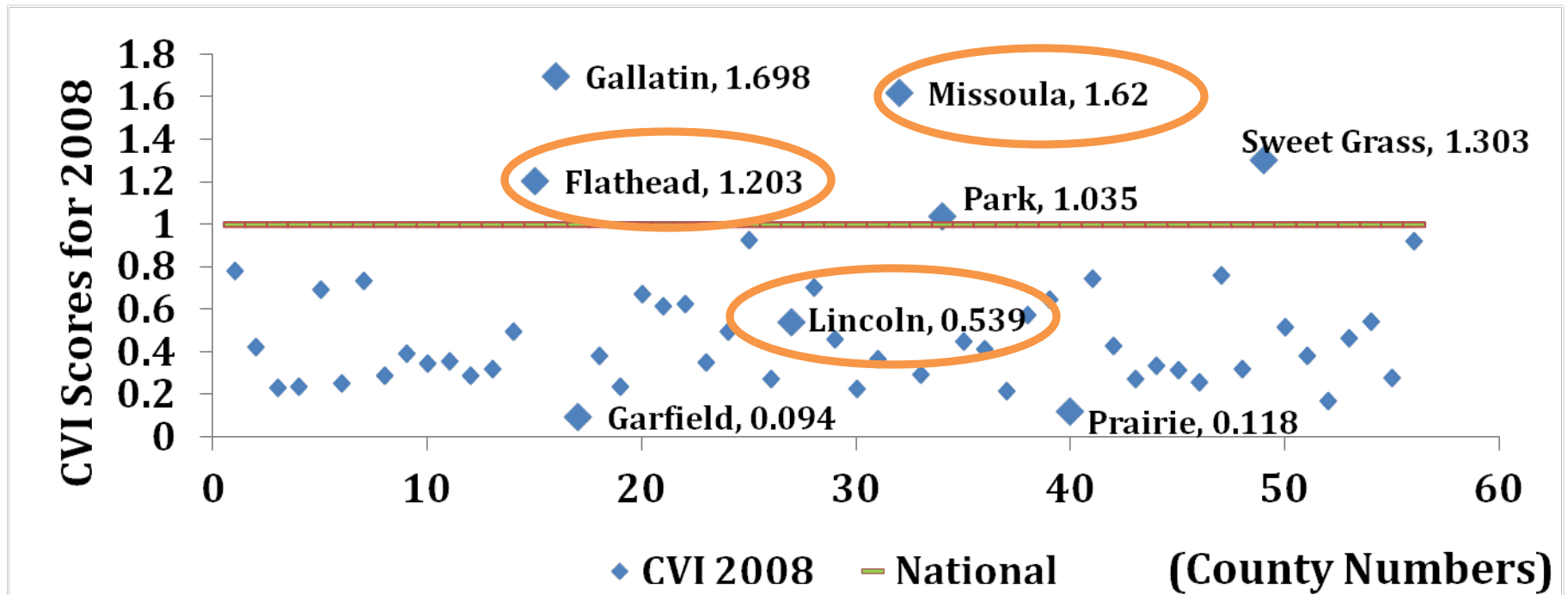
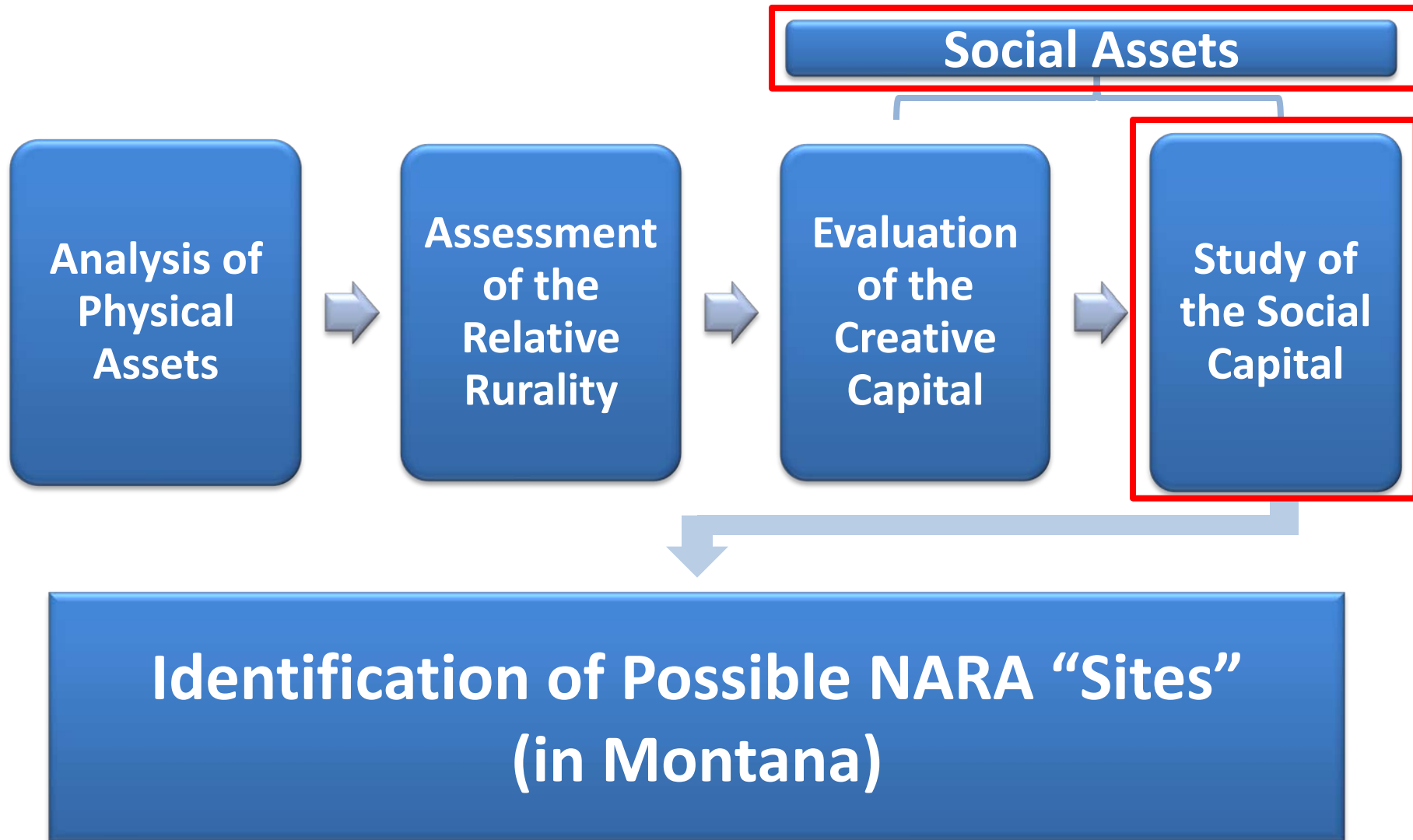


Figure 2. Scatter plot of CVI Score for Montana Counties (2008)

## II. Analysis – Roadmap (Montana)



# Social Capital Measurements

## 1. Putnam Groups (PG) Score:

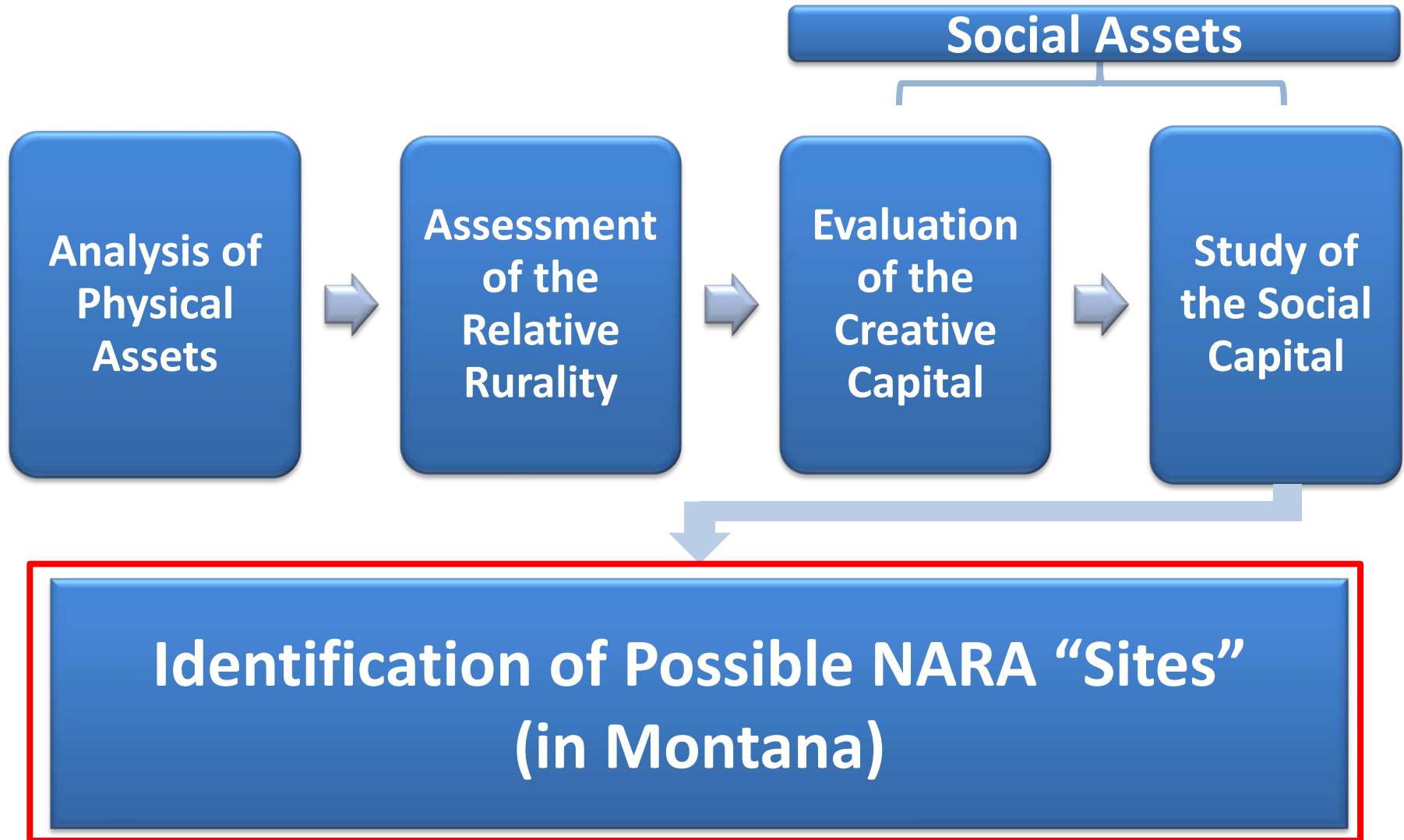
- Predicts community-level **adaptation to economic change**
- Measures presence of organizations that **expand society's economic, social, & environmental wealth**

## 2. Overall Social Capital (OSC) Score:

- Composite measure of **non-profit density, census survey & voter participation rates**
- Measures **collective action to achieve shared goals** – based heavily on “trust”



## II. Analysis – Roadmap (Montana)



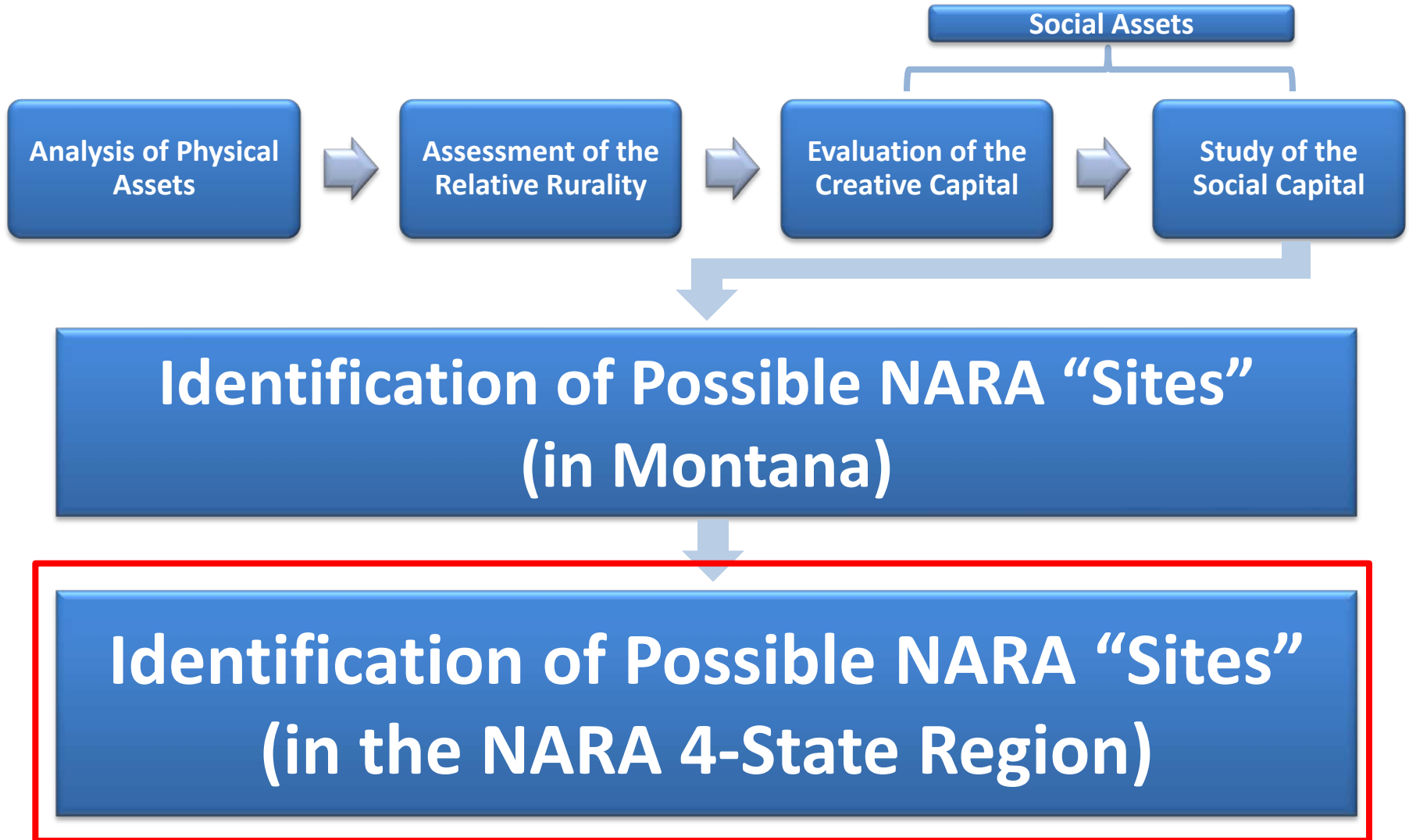
# Table 1. Analysis of the Physical & Social Assets

County	Forest Residue (cu.ft.) 2004	IRR 2000	CVI 2008	Putnam Groups 2000	Overall Social Capital 2009
Flathead	11,722,800	0.531	1.203	13.388	0.693
Lincoln	8,310,650	0.654	0.539	13.850	0.713
Missoula	8,280,130	0.316	1.620	9.345	1.533
Sanders	5,547,260	0.72	0.313	10.728	1.018
Powell	3,629,180	0.500	0.644	5.656	-0.084
Mineral	2,767,250	0.73	0.362	13.423	1.463
Lake	2,465,490	0.589	0.492	10.260	0.356
Granite	1,713,000	0.75	0.669	3.799	1.599
Powder River	1,681,880	0.88	0.571	20.953	4.511
Lewis and Clark	1,475,520	0.418	0.925	11.643	2.144
Fergus	1,428,070	0.598	0.496	17.603	1.665
Ravalli	1,158,790	0.614	0.743	9.261	0.654
Jefferson	964,112	0.74	0.622	2.025	0.565
Glacier	714,777	0.611	0.378	10.247	-0.472
Carter	693,280	0.91	0.251	13.307	2.541
Park	651,528	0.594	1.035	13.828	1.844
Gallatin	613,440	0.540	1.698	11.127	0.663
Rosebud	604,019	0.75	0.333	9.795	1.038
<b>National Ave.</b>	--	--	<b>1.00</b>	<b>11.78</b>	<b>0.00</b>

# Table 1. Analysis of the Physical & Social Assets

County	Forest Residue (cu.ft.) 2004	IRR 2000	CVI 2008	Putnam Groups 2000	Overall Social Capital 2009
Flathead	11,722,800	0.531	1.203	13.388	0.693
Lincoln	8,310,650	0.654	0.539	13.850	0.713
Missoula	8,280,130	0.316	1.620	9.345	1.533
Sanders	5,547,260	0.72	0.313	10.728	1.018
Powell	3,629,180	0.500	0.644	5.656	-0.084
Mineral	2,767,250	0.73	0.362	13.423	1.463
Lake	2,465,490	0.589	0.492	10.260	0.356
Granite	1,713,000	0.75	0.669	3.799	1.599
Powder River	1,681,880	0.88	0.571	20.953	4.511
Lewis and Clark	1,475,520	0.418	0.925	11.643	2.144
Fergus	1,428,070	0.598	0.496	17.603	1.665
Ravalli	1,158,790	0.614	0.743	9.261	0.654
Jefferson	964,112	0.74	0.622	2.025	0.565
Glacier	714,777	0.611	0.378	10.247	-0.472
Carter	693,280	0.91	0.251	13.307	2.541
Park	651,528	0.594	1.035	13.828	1.844
Gallatin	613,440	0.540	1.698	11.127	0.663
Rosebud	604,019	0.75	0.333	9.795	1.038
<b>National Ave.</b>	--	--	<b>1.00</b>	<b>11.78</b>	<b>0.00</b>

# III. Future Activity



# Future Work

- Refine datasets & develop indices – forest biomass to biofuels
- County-level view of the NARA 4-state region vs. US provides areas of high-low potential for subsequent validation
- Validated relationships may be applied to the greater NARA region & nation

# Thank you

Northwest Advanced Renewables Alliance (NARA)  
Sustainability Measurement Team

## Acknowledgement:

*“This work, as part of the Northwest Advanced Renewables Alliance (NARA), was funded by the Agriculture and Food Research Initiative Competitive Grant no. 2011-68005-30416 from the USDA National Institute of Food and Agriculture.”*

# References

- Campbell, C. (2001), "Social capital and health: Contextualising health promotion within local community networks." Published in Barson and Schuller (2001) Social capital: critical perspectives. Oxford University Press. pp. 182-196
- Cote S., and T. Healy (2001) The Well-being of Nations. The role of human and social capital. Organization for Economic Co-operation and Development, Paris
- Florida, R. (2002) The rise of the creative class. New York: Basic Books.
- Florida, R. (2003) Cities and the creative class. City and Community 2:1 March 2003.
- Halpern, D. (1999) Social capital: the new golden goose? MIMEO, Social and Political Sciences, Cambridge University.
- Fukuyama, F. (1995) Social capital and the global economy. Foreign Affairs. 74(5):89-103
- Fukuyama, F. (2000) Social Capital and Civil Society. International Monetary Fund. Working Paper. WP/00/74.
- Pierce, J.C., N.P. Lovrich, and H.S. Elway (2011) Chapter 1: the political culture of Washington state. Governing Washington: Politics and Government in the Evergreen State. Eds. Cornell Clayton and Nicholas Lovrich. Pullman, WA: Washington State University.
- Putnam, R. D. (1996) Who Killed Civic America? *Prospect* (March): 66–72.
- Rice, T. W. and J. L. Feldman (1997) Civic Culture and Democracy From Europe to America. *Journal of Politics* 59 (4): 1143-72.
- Waldorf, B.S. (2006) Continuous multi-dimensional measure of rurality: moving beyond threshold measures. Department of Agricultural Economics, Purdue University. West Lafayette, U.S.
- WESTAF (2010) The creative vitality index: an overview. Western States Arts Federation. Accessed online: [http://www.westaf.org/publications\\_and\\_research/cvi](http://www.westaf.org/publications_and_research/cvi).
- Wilkinson, Richard G. (1996) Unhealthy societies: the afflictions of inequality. London: Routledge.
- Zhang, F, D.M Johnson, and J.W Sutherland (2011) A GIS-Based Method for Identifying the Optimal Location for a Facility to Convert Forest Biomass to Biofuel. *Biomass and Bioenergy*. 35.9 (2011): 3951-3961. Print.

# Social Assets - Social Capital

## Social Capital - contributes to:

- Effectiveness of gov't (Rice & Sumberg 1997)
- Economic growth (Fukuyama 2000; Halpern 1999)
- Low crime rate (Cote & Healy 2001; Halpern 1999)
- Improved health (Campbell 2001; Wilkinson 1996)
- Reduced incidences of other social problems