Sustainable Development & the Research Agenda

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Sustainable Development

Development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.”

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The Research Agenda: Eight Challenges

These are far from the only challenges, but these eight are very difficult:

- World **population** is increasing –a 300% increase since 1950
- **Per capita minerals use** is increasing, and for some minerals clearly needs to keep increasing if we are to meet the needs of the poor (e.g., copper for electrification)
- Increased population creates increased **competition with other land uses** – agriculture, housing, space for biodiversity, watersheds are all under pressure
- Mining is very **energy intensive**, and somehow needs to produce more with less energy

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The Research Agenda: Eight Challenges

(con't):

- Mining is very **water intensive**, and somehow needs to produce more with less water
- For many minerals, there is an important need to identify **additional sources of supply**
- Mining moves more material than any other human activity (except maybe soil erosion). It generates very large volumes of waste and it is not clear **how much the biosphere can absorb**
- Where are the **technologies** that can meet our needs with reduced amounts of minerals, to recycle and reuse more easily, or to produce virgin materials with less footprint?

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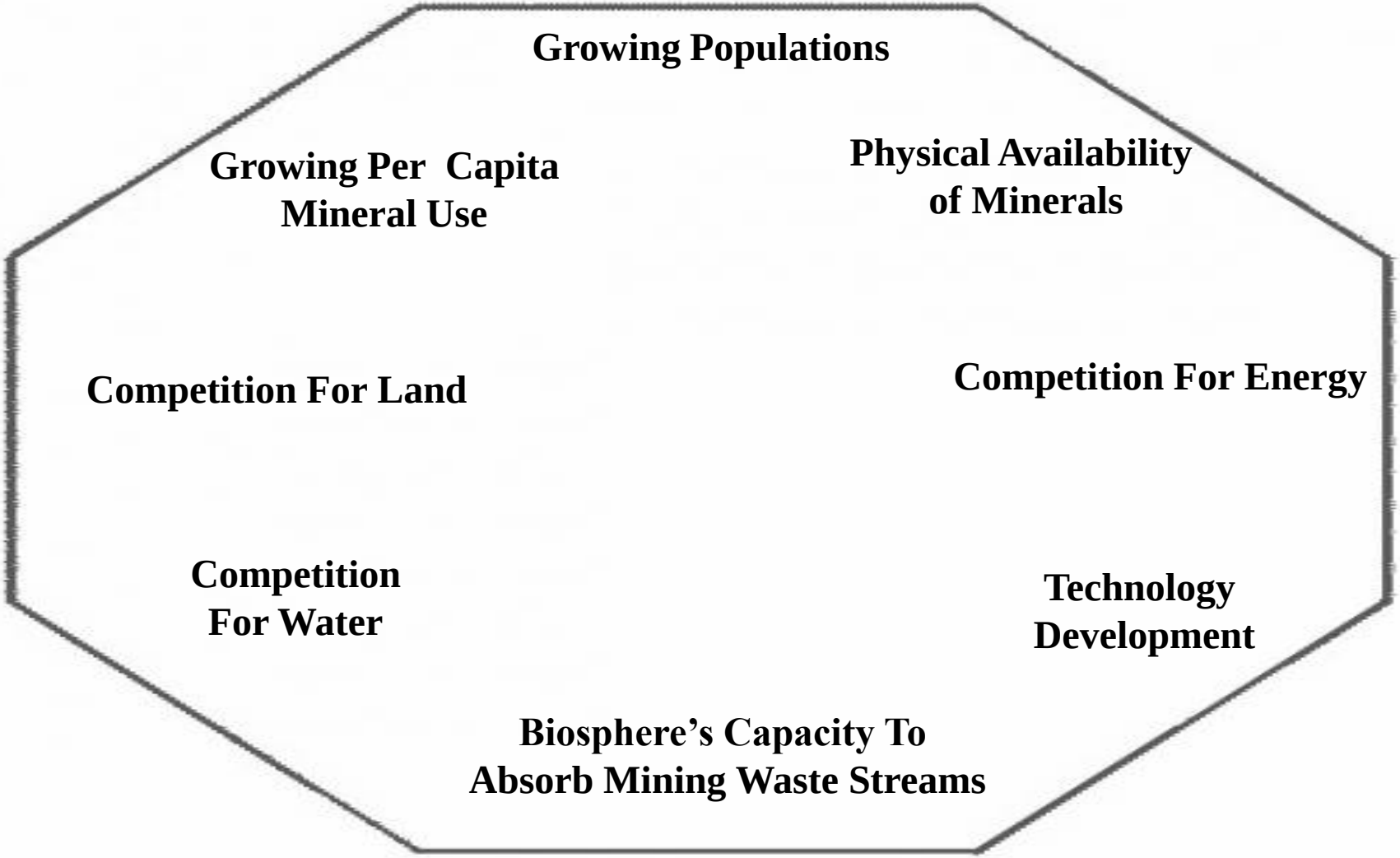
Eight Challenges to Sustainable Development of Minerals



FROM COERCION TO CONSENT

- The tendency has been to move from systems based on coercion to systems based on consent
- Under the colonial system, colonies were not asked for their consent
- A desire to be able to manage mineral resources for local benefit was a major driver of independence movements and the end of the colonial era

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THE ‘VOICE OF COMMUNITIES’

- The increasing demand of communities that they not be impacted by development without their consent is simply a continuation of previous trends
- It appears we need to learn how to meet all these challenges while at the same time learning how to adapt to a consent based system

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CONCERNS OF INDIGENOUS COMMUNITIES

- Indigenous peoples live in many areas that are of considerable mineral interest
- But we have to acknowledge the past relationships have been unacceptable
- There needs to be a complete rethink of the relationship with indigenous communities
- Consent needs to be a cornerstone in future relationships

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Not All Minerals Are The Same

Over 90 minerals are commonly produced. They vary enormously in:

- Abundance
- What substitutes there are for them
- The environmental impacts of their production and use
- How much employment they generate

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USE MAKES A DIFFERENCE

- Uses that lend themselves to recycling and reuse
- "Dispersive" uses, such as lead in gasoline, copper in paint, or burning coal

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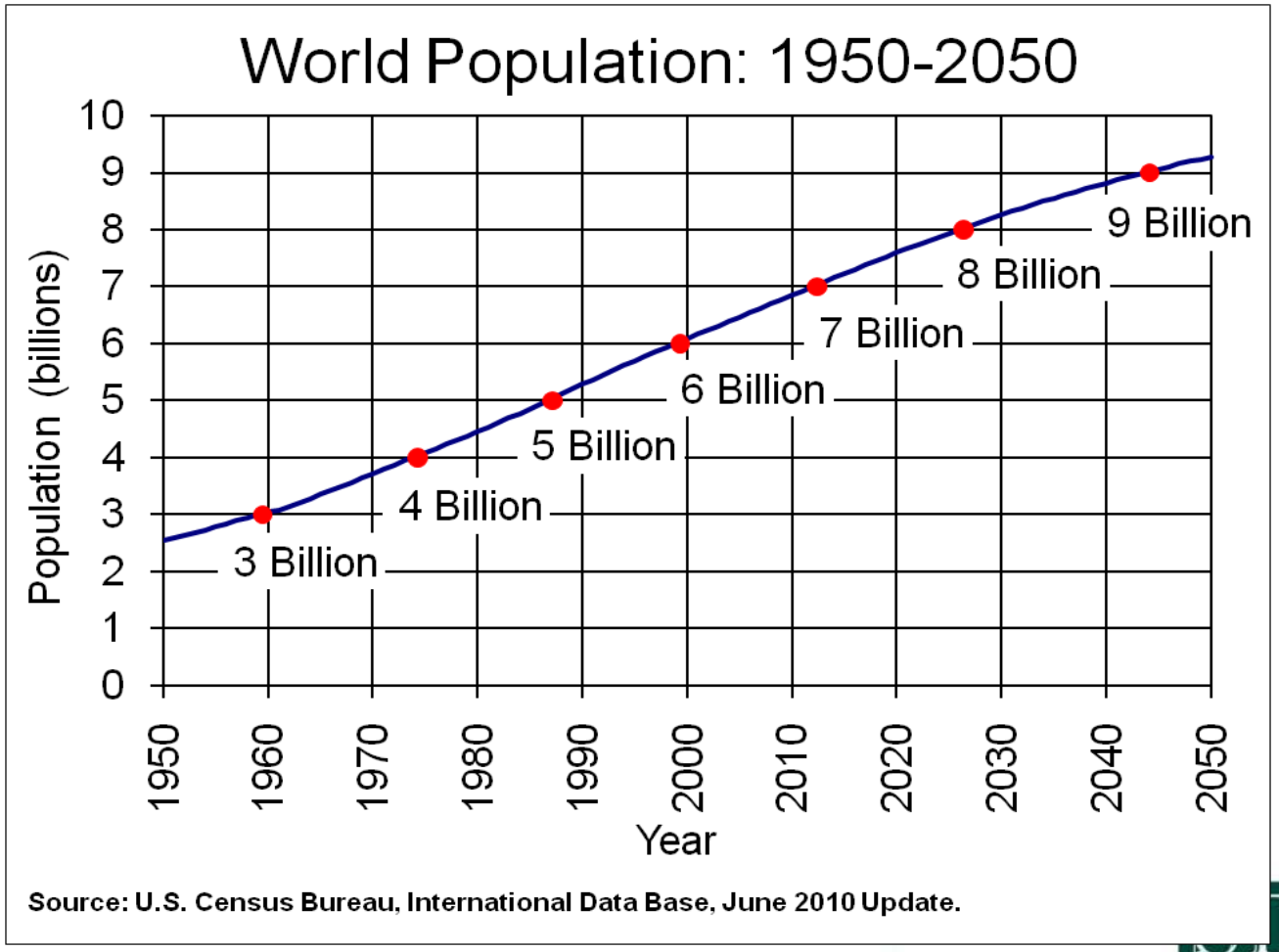
A Growing World Population



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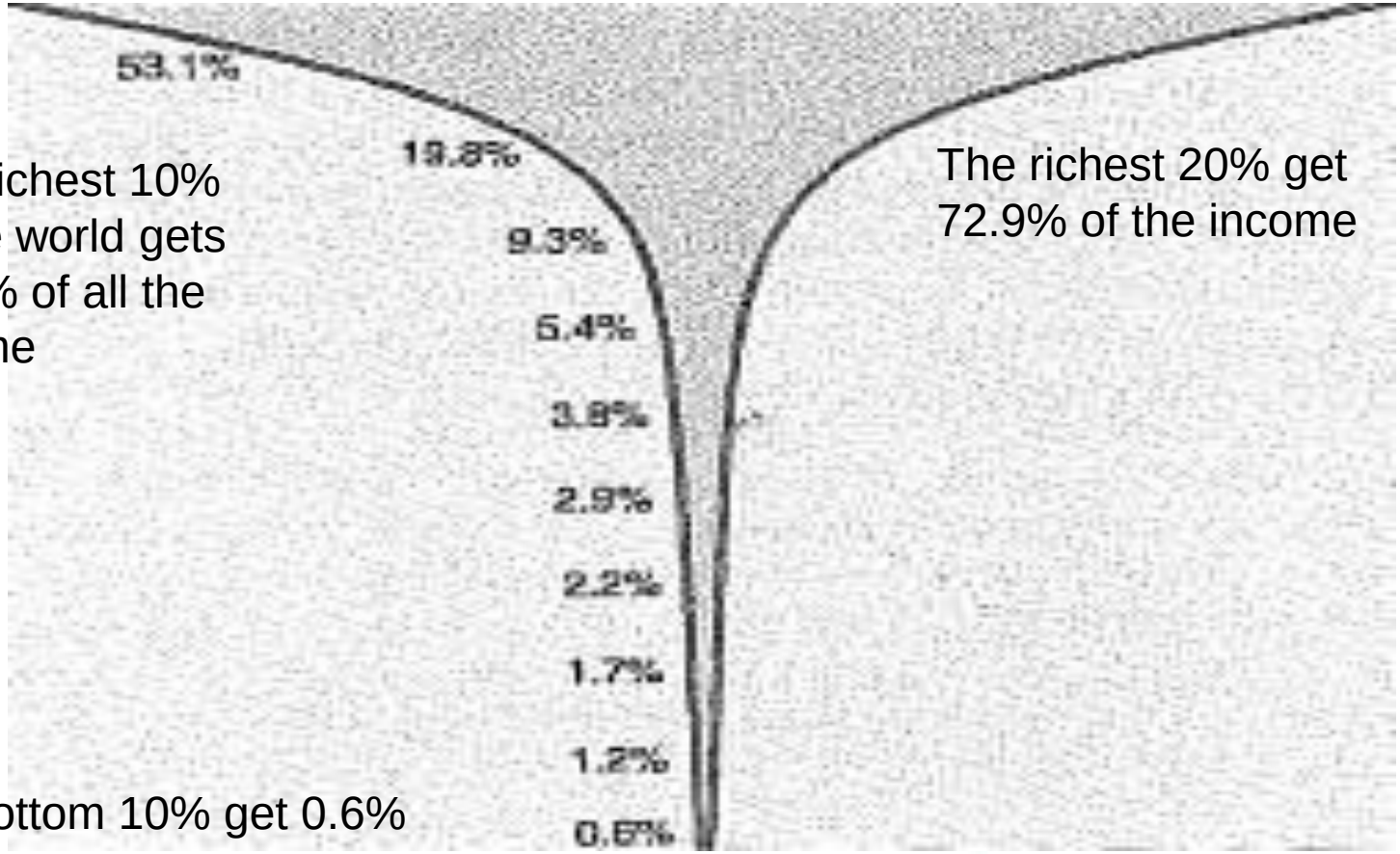
Global Income Distribution



The richest 10% of the world gets 53.1% of all the income

The richest 20% get 72.9% of the income

The bottom 10% get 0.6%

"Trends in Global Income Distribution 1970 – 2000, and Scenarios for 2015," UNDP Human Development Report Office Occasional Paper (2005).

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Minerals Drive Development

- Copper
  - Essential for electrification and rising standard of living. Also important to housing, auto, information technology & alternative energy
- Steel (iron, molybdenum, etc.)
  - Essential for construction/industrialization
- Consumption increases very rapidly as countries begin to industrialize and incomes pass threshold level.

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Copper Consumption per Capita

(tons per person, 17 of 20 most populous countries)

- **Table 3.** Copper consumption per capita (tons per person) in 17 of the 20 most populous countries in the world.

	1970	1975	1980	1985	1990	1995	2000
China	0.00022	0.00016	0.00038	0.00049	0.00051	0.00101	0.00168
India	0.00010	0.00006	0.00009	0.00014	0.00013	0.00013	0.00040
USA	0.01005	0.00794	0.00976	0.00664	0.00794	0.00962	0.01125
Indonesia	0.00001	0.00005	0.00014	0.00009	0.00018	0.00043	0.00030
Brazil	0.00054	0.00121	0.00229	0.00164	0.00119	0.00157	0.00225
Russia	0.00239	0.00270	0.00394	0.00312	0.00342	0.00060	0.00138
Japan	0.00894	0.00794	0.01060	0.01094	0.01279	0.01154	0.01034
Mexico	0.00098	0.00090	0.00191	0.00182	0.00140	0.00053	0.00580
Germany	0.01195	0.01308	0.01278	0.01398	0.01727	0.01255	0.01643
Philippines	0.00011	0.00008	0.00010	0.00001	0.00032	0.00048	0.00022
Iran	0.00012	0.00023	0.00003	0.00030	0.00085	0.00140	0.00159
Egypt	0.00002	0.00009	0.00005	0.00005	0.00006	0.00007	0.00007
Turkey	0.00000	0.00027	0.00060	0.00180	0.000183	0.00250	0.00259
Thailand	0.00000	0.00005	0.00010	0.00053	0.00097	0.00265	0.00259
UK	0.01017	0.01001	0.00795	0.00724	0.00722	0.00509	0.00618
France	0.00678	0.00773	0.0857	0.00684	0.00840	0.00993	0.00988

Some Implications of Changing Patterns of Mineral Consumption
***By* W. David Menzie, John H. DeYoung, Jr., *and* Walter G. Steblez, USGS (2000)**

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Replacing Reserves

Example: Copper

- 1.1 billion tons of copper must be added to reserves to meet projected copper consumption at present recycling rates

- Maintaining current reserve level will require more than 3 times the amount of copper in the 5 largest deposits currently known

- Big discoveries, big problems

(e.g., Oyu Tolgoi, Mongolia)

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Availability of Minerals

- Minerals are only physically available where we find them – although we keep finding them in new places
- The technical challenges of finding and producing minerals to meet future demand are considerable
- But the most difficult challenges may be the social and political issues of finding some way to integrate mineral production better with other land uses in an increasingly crowded world
- Deciding who has a say, and how

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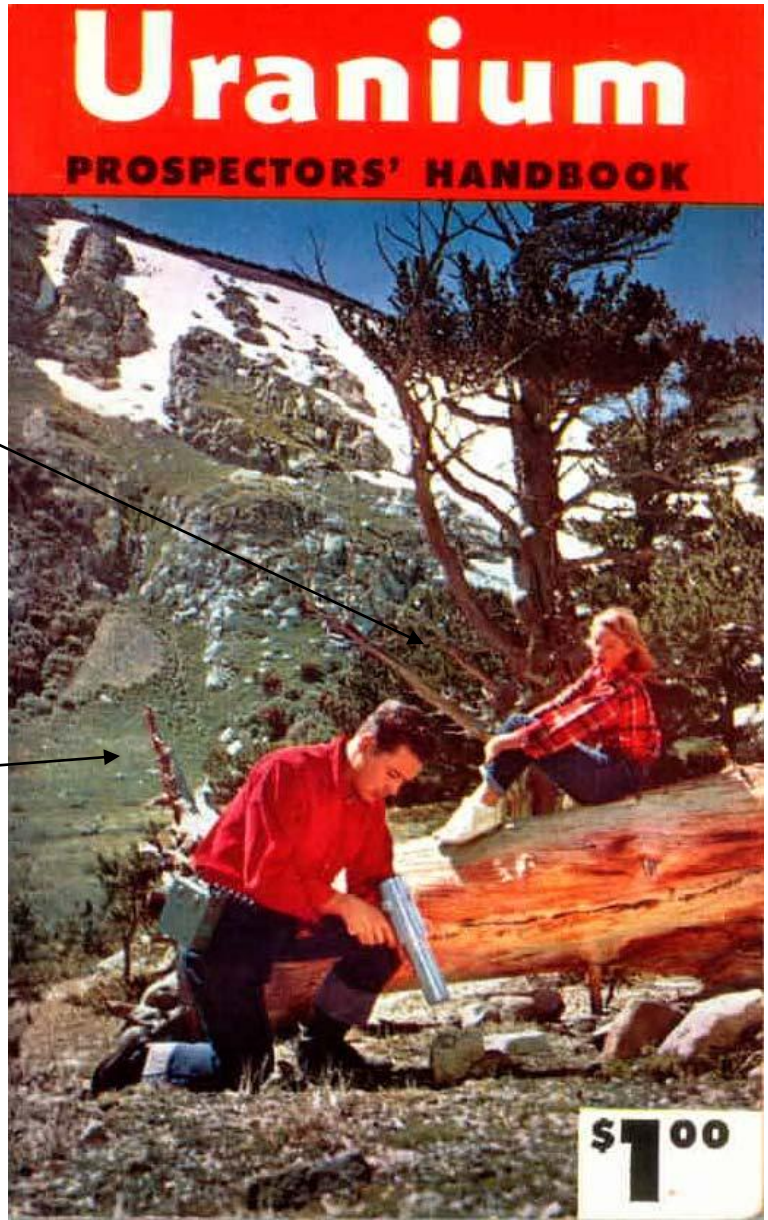
Exploration Requires Community Acceptance



Community

Miner

How communities felt about Uranium, ca. 1954

Competition for Land

- **Competing Land Uses**
  - Agriculture
  - Urban Development
  - Retaining Land in State of Nature: Preserving Rare or Important Ecosystems
  - Tourism
  - Recreational Use
- **Relative economic value of competing uses**
  - Effect on land prices, making mining uneconomic
  - Thus, mining disproportionately affects poor/rural people

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Competition for Land

From Frontier Settlements. . .

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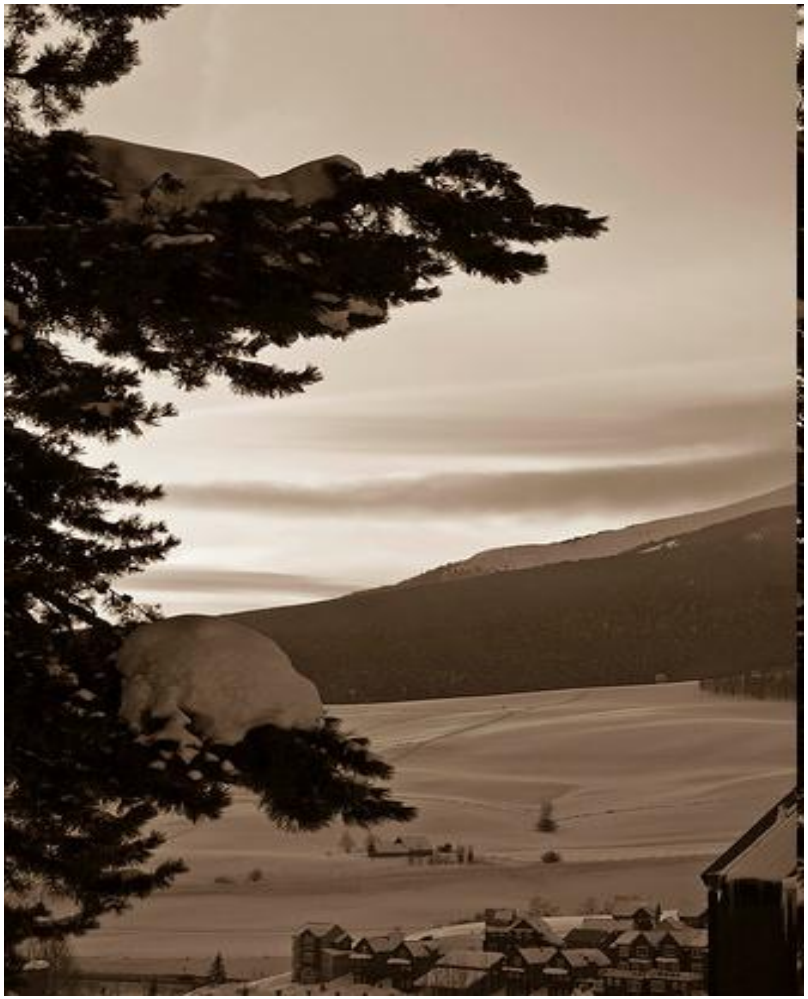
Competition for Land



. . . To Ski Areas

-Is skiing more important than mining?
-In the Gunnison Valley?
-In the United States?
-To the poor in developing countries?

Competition for Land

- "What Every Westerner Should Know About Energy" by Patricia Nelson Limerick, et al., Center for the American West (2003)
  - "**Aren't there any unloved and unlovely places left**?"
  - Argues for reconciliation among competing interests

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Competition for Energy

- Mining is energy-intensive.
  - Drilling/digging; crushing, milling, refining; pumping out water; transport, etc.
  - Competitors for energy include urban users w/ rising standards of living, infrastructure building and other industry
- Energy represents about 5% of the value of all mining products.
- R&D projects include technologies for energy-efficient mining and processing of coal, metals, and industrial minerals.

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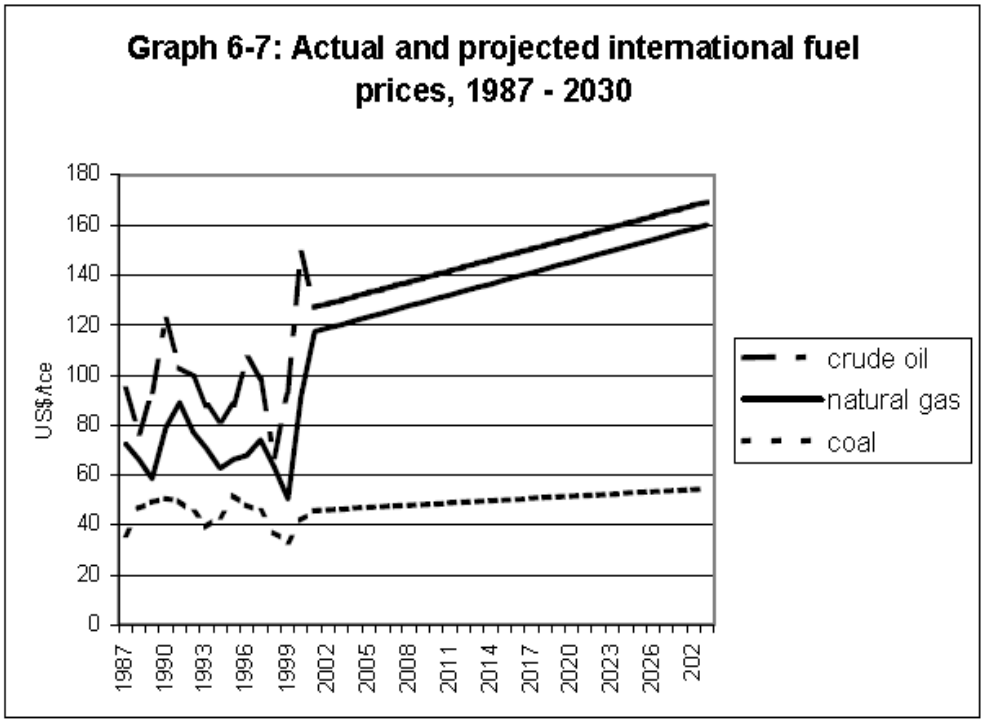
Fuel Prices



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Competition for Water

- Mining is water-intensive
  - Dust control
  - Reduce fire hazard: ex.: underground coal mining
  - Extracting ore; processing
  - Transport: mineral slurries
- Competing Uses
  - Agriculture
  - In-stream flows
  - Urban/industrial uses
  - Tourism/recreation

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Improving Capacity of Biosphere

- Reduce waste streams
  - New technologies to mine, process, transport
  - Life-cycle pollution management
  - Shift from high-polluting minerals
- Reduce energy consumption
  - Mining, processing, transport
  - New sources of energy
  - Energy-efficient products with mineral components

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Improving Capacity of Biosphere

- Land reclamation & post-mining monitoring
  - Improve predictive abilities for water impacts
  - Funding
  - Enforcement
- Reduce mining
  - Recycling
  - Substitution
  - Place ecologically sensitive areas off limits (exploration vs. mining)

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Eight Challenges: Examples are Everywhere

- Molybdenum under Mt. Emmons, Colorado
- Rare Earths at Mountain Pass, California
- Copper/gold deposits at Tampakan, Philippines
- Cerro Quilish, Peru
- Esquel, Argentina

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Needed Research

- There may be no more important issues for the future of minerals development than community acceptance, the "social license to operate." Yet while there is an enormous amount of propaganda out there on all sides, there is almost no rigorous **research that shows the impacts on communities**:
  - When they go from a pre-mining state to the potentially disruptive construction phase
  - When they move from the large scale construction phase to a more steady state of production
  - When the mine closes and the community is left without an activity that is central to the local economy.

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Needed Research

There is very little attempt to understand in a rigorous way the risk-benefit calculation for communities

- What costs are going to be externalized onto the community?
- What will be the direct and indirect benefits?
- What benefits will be externalized?
- What risks will the community be asked to run?
- Above all, does the community have any kind of say over the outcome? If so, what?
- Can community needs be balanced with tenure systems and commercial needs and expectations to attract mining investment in the first place?

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Needed Research

Community concerns about the distribution of the benefits, risks, and impacts of large mining projects have led to considerable opposition to mine development in many parts of the world.

Greater access to information and communications technology, more open societies, greater access to legal remedies and other factors, not all of which have been identified, have given communities more leverage, and have in rich and poor countries alike prevented projects from going forward.

Are there things that can be done to improve the balance of risks, benefits, opportunities and impacts so that communities will accept and want these projects when society needs them?

To what extent is the problem simply a function of defects in our systems of consultation and community engagement?

Are these facilities so important that we need legal provisions to facilitate development? Is that politically viable in a democratic context?

1. Where are the gaps in our knowledge?
2. What research do we know of that is relevant to this problem?
3. What kind of research approaches make sense?
4. Who can undertake this kind of work?

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Questions?

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