Environmental Risk Syllabus ○

by Hiroyuki Matsuda

http://ecorisk.ynu.ac.jp/matsuda/lecture/risk-in-tokyo.html

- What are risk and risk management? P-1 ppt
- Population risk assessment of zinc concentration p-2
- Radioactive Risk by Fukushima I NPP Ppt
- IUCN Redlist based on extinction risk p-11
- Fisheries risk management p-5
- Adaptive deer management in Hokkaido p-7
- Reconciling human security with bear persistence p-10
- Cull limit of Steller sea lions in Japan p-6
- Resource economics of exotic mongoose control p-9
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- Guideline of Nature Restoration Projects p-12
- Transdisciplinarity & regulatory science based on risk science p-12

Do not copy-&-paste from web sites

- I heard that some students submitted reports or published documents / articles that copied some sentences from the website last year. If such plagiarism or injustice is found, they may be punishable more than a failure.

Keywords: Risk for ecotoxicology

- Biodiversity, Ecological risk, Ecosystem service, Endpoint, Environmental economy, Environmental risk, Hazard, Human health risk, Pollution, POPs, Precautionary principle , Prevention, Rio declaration , Risk, Risk assessment, Risk communication, Risk management, Scenario, Type II error, Uncertainty , Weight of evidence, Acute toxicity, Chronic toxicity, DDT, Dose-response curve, Ecotoxicology, Endocrine disrupter, Extrapolation, High risk group, LC50, LNT, LOAEL , NOAEL , QSAR, Risk-benefit analysis, Safety coefficient, Sensitivity , TBT, Threshold model, Effluent standard , Environmental standard , HC5, Non point source, Species sensitivity distribution

Keywords: Risk for conservation ecology

- Demographic stochasticity, EIA, Expected loss of biodiversity, Extinction risk, PVA, Redlist, Density effect, Discount rate, Ecological footprint, MSY , Overexploitation, TAC, Accountability, Adaptive management, AIC, Bayesian estimation, Confidence interval, Likelihood, Matrix population model, Maximum likelihood method, Measurement error, Population dynamics, Process error, State space model,

Keywords: Risk for Environment Policy

- MVP, Endangered species act, Environmental stochasticity, PBR, Scientific committee , Threatened, climate change, mitigation, adaptation, Cost-effective, CPUE , Exotic species, Ecosystem approach, Ecosystem management, Feasibility, Multi-disciplinary, Natural disturbance, Participatory approach, Passive restoration, , Regulatory science, Resilience, Succession, Sustainable use , Transdisciplinarity, ABS, Bottle neck effect, Genetic diversity, GMO, Business risk, LCA, Risk tradeoff, Screening assessment, Conservation ecology, game theory, Nash solution, the tragedy of the commons

Variety of risks

- Risks: disaster, public safety, environment, business, security etc.
- Environmental risks: human health, ecology, climate change etc.
- Ecological risks: biodiversity, ecosystem services
- Biodiversity: extinction risk, living planet index
- Ecosystem services: provisioning, regulating, cultural

What is risk? = Endpoint, hazard and probability

- **Assessment endpoint**:
  - An event that is undesired
  - e.g., cancer, death, species extinction, …
- **Hazard**:
  - How severe is it when the undesired event happens
- **Probability**
  - That the endpoint happens.

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A big problem—Scenario!

- The probability that the endpoint happens is usually uncertain.
- We usually calculate the risk under unverified assumptions and policy (scenario).
- We must describe what scenario we used!
- **Risk** = {Scenario, hazard, probability}

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Risk analysis consists of:

- Risk assessment: to identify a risk, and to evaluate the magnitude of the risk.
- Risk management: to control the magnitude of risks under some actions or rules
- Risk communication: to inform and choose a desirable (or non-regret) policy under the knowledge of risks.

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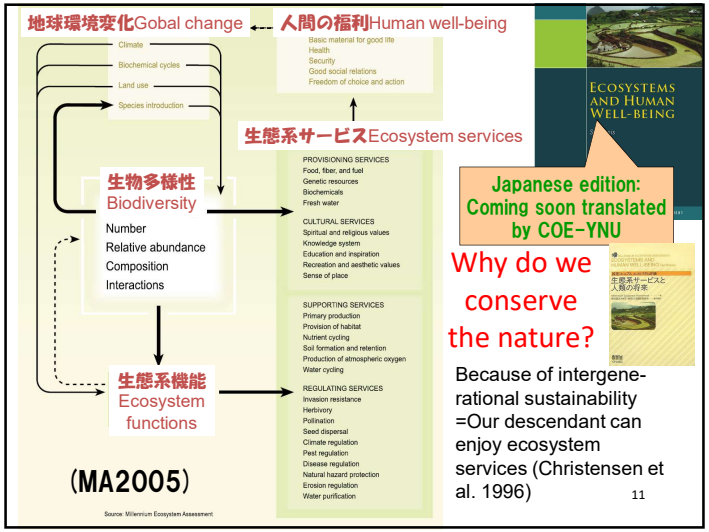
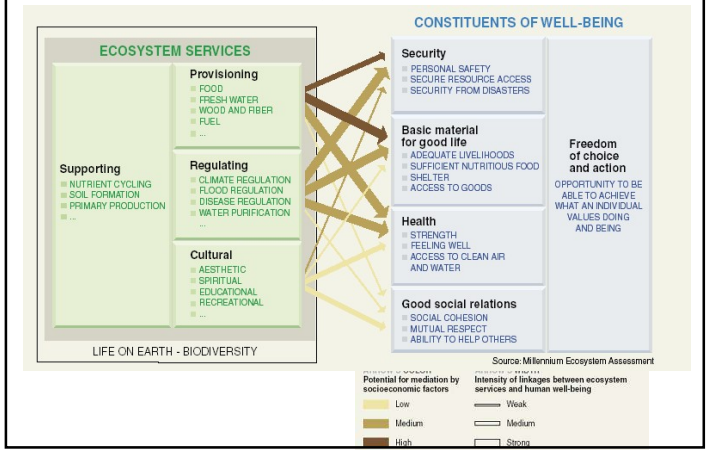
Environmental risk includes

- Human health risk = increasing mortality of human or loss of "quality of life"
- Ecological risk = loss of biodiversity or ecosystem services, it may increase human health risk in future generations.
- Why do we consider eco-risk? ∵ We cannot directly account of impacts on well-being of our descendants. (中西準子「環境リスク論」)



Ecosystem services and well-being

(Millennium Ecosystem Assessment 2004)



3 types of ecosystem services

http://www.ecolomics-international.org/headg_biosafety.htm

Prevention vs precaution

- **Prevention** is based on **certainties**: it rests on cumulative experience concerning the degree of risk posed by an activity (Russian roulette, for example, involves a predictable one-in-six chance of death).
- **Precaution** is used when scientific research has not yet reached a stage that allows the veil of **uncertainty** to be lifted.

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http://ecorisk.ynu.ac.jp/matsuda/2006/060117.ppt

予防原則と統計学
Precautionary Principle (PP) and statistics

- **第1種の過誤：無用の対策を採る**
  Type I error: Doing unnecessary actions
- **第2種の過誤：採るべき対策を怠る**
  Type II error: Not doing necessary actions
- **科学は第1種の過誤を避ける（有意差5%）**
  Science usually avoids type I errors (5% rule).
- **予防原則は第2種の過誤を避ける（定量的・定性的評価基準がない）** PP avoids type II errors (no quantitative nor qualitative rule).

Two measures in risks

- Risk (type II errors)
  - Probability × hazard
- The weight of evidence (type I errors)
  - How certain is it?

Do you use mobile phone in airplane? Why not?

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http://ecorisk.ynu.ac.jp/matsuda/2006/060117.ppt

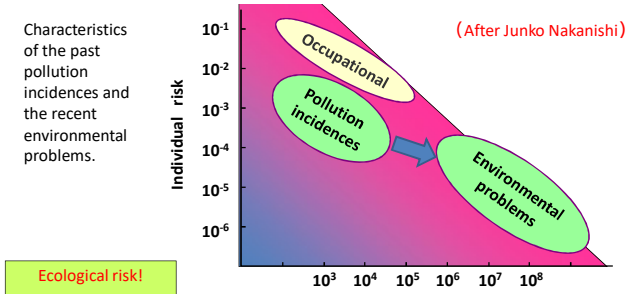
予防原則precautionary principle

- **環境を保護するため、予防的方策は、各国により、その能力に応じて広く適用されなければならない。深刻な、あるいは不可逆的な被害のおそれがある場合には、完全な科学的確実性の欠如が、環境悪化を防止するための費用対効果の大きい対策を延期する理由として使われてはならない。**
- In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

1992年リオ宣言第15原則 Rio Declaration Principle 15 http://www.unep.org/

Human Health Risk

Characteristics of the past pollution incidences and the recent environmental problems.



(After Junko Nakanishi)

Ecological risk!

The per capute risk in the past was high, but the number of people affected was limited. The present per capita risk, with the newly-emerged environmental issues, is realtively small, while the number of people affected is big.

-The present risk is more ubiquitous, and is … unclear in nature.

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Junko Nakanishi

Weekly intake of each fish

	Weekly intake of each fish (g)	concentration of methyl mercury (ppm)	Mercury intake from each fish (μg/week)
Intake from non-seafoods			11.9
sharks	10	0.35	3.5
sea bream		0.33	0.0
bluefin tunas	160	0.54	86.7
whales	5	0.12	0.6
shellfish	20	0.49	9.7
anchovy	240	0.03	7.9
mackerel	0	0.21	0.0
total	**435**		**120.3**
		total(μg/day	**17.2**

(Souce: Japan Ministry of Health 2005, Nakanishi et al. 2003)
http://ecorisk.ynu.ac.jp/matsuda/2005/aquanet.htm

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Risk of mercury

	Mercury intake (μg/day)	% in Red blood cell (ppm)	Risk for adults	Risk for embryos
your case	**14.9**	0.024	1.4E-06	7.8E-05
Threshold for adults	25.0	0.038	1.1E-05	0.0005
Threshold for embryos	15.7	0.025	1.7E-06	9.5E-05
Average intake of Japanese	8.4	0.015	1.3E-07	7.6E-06
Average in 1960s	98.0	0.140	0.0013	0.0236
Minamata disease in 1960s	1250.0	1.753	0.2771	0.6709
Tuna eater (250g/day)	137.2	0.195	0.0036	0.048

(Source: Japan Ministry of Health 2005, Nakanishi et al. 2003)
http://ecorisk.ynu.ac.jp/matsuda/2005/aquanet.htm

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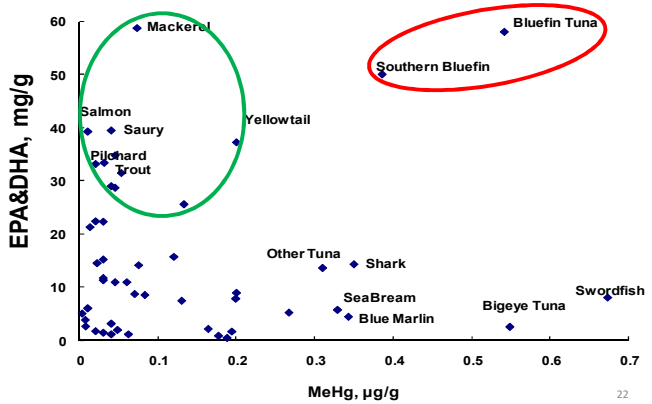
張璞2009

PUFA/MeHg Concentration



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Rodricks "Calculating Risks"

Fallacy of Zero-Risk

Risk factors	Mortality	リスク要因	死亡率
Motorcyclingバイク	2000	Rodeoロデオ	3
All factors全死亡要因	1000	Fire火事	2.8
Smoking喫煙	300	Trihalomethan etc	0.8
Cancer from smoking	120	Peanut butter 3spoons/day	0.8
Fire fighting消火活動	80	Beef steak 85g/day	0.5
Hung glider	80	Flood洪水	0.06
Coal mining炭鉱	63	Struck by lightening落雷	0.05
Farmwork農作業	36	Falling stars流星直撃	$<10^{-5}$
Automobile自動車	24		
The number of died person per 100,000 per year			

生涯リスクは上記の数字が（松田注:年齢，年代により）大きく変わらないとすれば約70倍したものとなる．

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Expected Loss of Longevity

- If cancer probability = 10^{-5} and 10 years life expectancy are lost, then
- Expected loss of longevity = 0.7 hours!!
- We can compare ELL between various sorts of risk factors.

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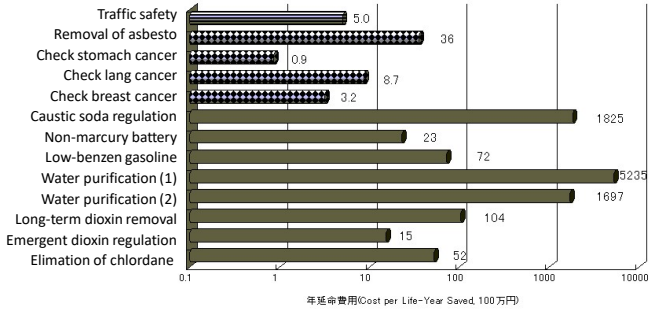
After A. Kishimoto's doctoral dissertation

Costs of avoiding health risks



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"Report"

- ~~Please find case that precautionary measures is not appropriately used, and explain the reason that you consider.~~
- ~~1-2 pages~~
- Send email to matsuda@ynu.ac.jp by tomorrow. (a few comments/brief questions)
- I would like to make a email list of class members

Science Diplomacy

1. Informing foreign policy objectives with scientific advice (science in diplomacy)
2. Facilitating international science cooperation (diplomacy for science)
3. Using science cooperation to improve international relations between countries (science for diplomacy)

https://www.nap.edu/read/13300/chapter/4#27
http://www.mofa.go.jp/mofaj/press/release/press4_002096.html

http://www.biodiv.org/convention/articles.asp?lg=0

生物多様性条約（1992）
Convention on Biological Diversity

- "*Noting also* that where there is a threat of significant reduction or loss of biological diversity, ***lack of full scientific certainty should not be used as a reason for postponing measures*** to avoid or minimize such a threat,

http://ecorisk.ynu.ac.jp/matsuda/2006/060117.ppt

国連気候変動枠組み条約
UNFCCC 1992

"Where there are threats of serious or ir-reversible damage, ***lack of full scientific certainty should not be used as a reason for postponing such measures,*** taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.

http://unfccc.int/

Science Advice to Governments

An Emerging Dimension of Science Diplomacy

By Peter D. Gluckman - 06.09.2016

- Technical advice
- Regulatory advice
- Deliberative advice
- Informal advice:
- Science advice in crises and emergencies:
- Beyond the formal structures of international organizations, an important role exists for science in many bilateral and multilateral negotiations and arrangements.

http://www.sciencediplomacy.org/article/2016/science-advice-governments 33

Open Science

- Digital data storage infrastructure (Creation of online)
  - Repositories and archives, libraries in research centers and governments
- Open Data (Promotion of)
  - Digital format for research outputs (*e.g.* funds)
  - Open Government
- Open Access (Promotion of)
  - Open licenses for datasets, libraries
  - Publication in open access journals or open resources (*e.g.,* funds)
- Collaborative work (Online)
  - Researchers industry society

https://www.oecd.org/sti/outlook/e-outlook/stipolicyprofiles/interactionsforinnovation/openscience.htm
http://okfn.jp/tag/open-science/も参照 34

Open Scienceの例1

Galaxy Zoo and the new dawn of citizen science

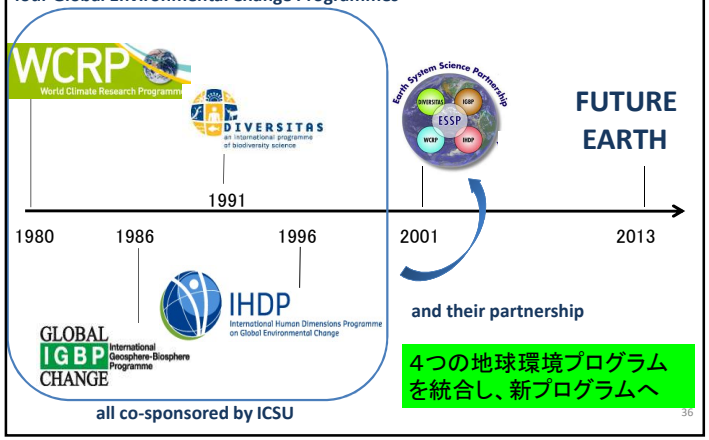
https://www.theguardian.com/science/2012/mar/18/galaxy-zoo-crowdsourcing-citizen-scientists

- Galaxy Zoo has enabled hundreds of thousands of amateur astronomers to map the obscure corners of the universe since 2007.

オープンサイエンスとは何か？https://ritsuan.com/blog/7630/
Galaxy Zooはオンライン上のプラットフォームです。ユーザーはプラットフォームで銀河の写真を複数の基準にそって分類していきます。
いかにして非専門家が科学に貢献できるかということがGalaxy Zooの例は示しています。従来、天文学研究者でない一般の市民であればこういった研究データや学問それ自体へのアクセスは限られていたと思います。ただ、Galaxy Zooはオンラインの力を利用することで人々へ天文学を開きました。
また、そこで発見されたことが学問へ様々な形で貢献しました。

Future Earth: a framework to unify existing bodies

https://www.slideserve.com/duaa/workshop-organising-committee



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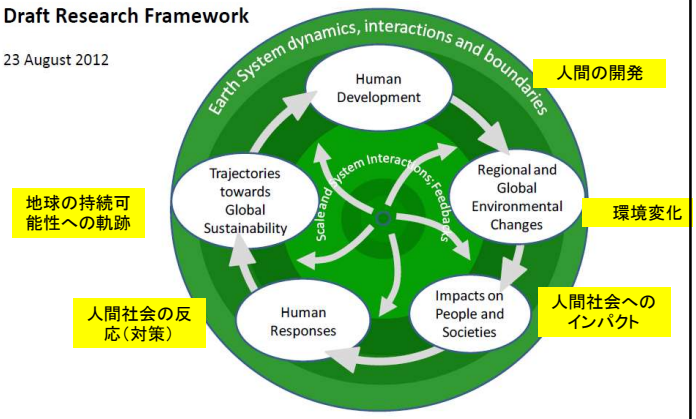
Future Earth – Research for Global Sustainability

Draft Research Framework

23 August 2012



Future Earth recognises that humanity is an integral part of the dynamics and interactions of the Earth system components and must work within its boundaries.

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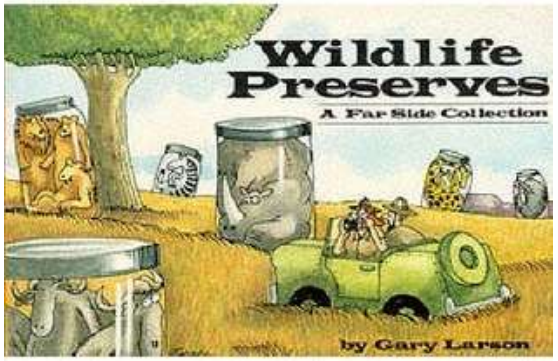
Preservation (Protection) vs. conservation



by Gary Larson (1989)

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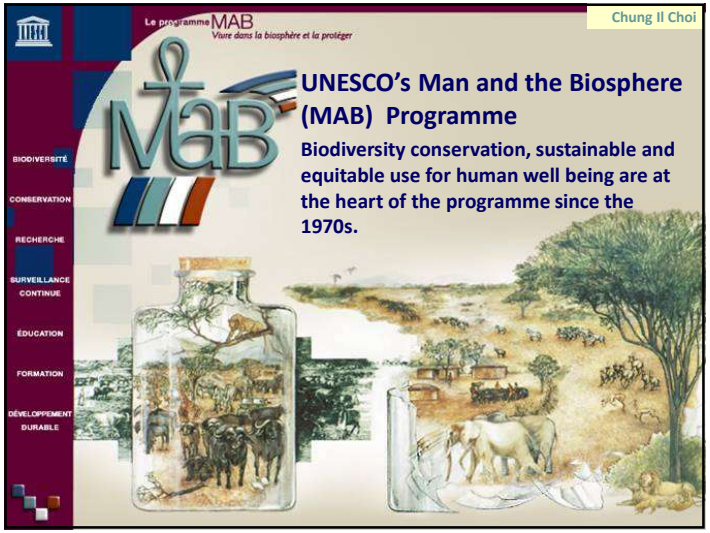

12 laws of ecosystem approach

Nairobi correspondence at CBD 2000 CoP5

1. Society will select the management goal
2. Decentralization of management
3. Think multi piled effect to other ecosystems
4. Management by economic sentence
5. Conservation form and function of ecosystem
6. Management at a limit of ecosystem function
7. Working on desirable time and space
8. Setting goal is from long-term perspective
9. Knowing change is unavoidable
10. Balance of conservation and usage
11. Entertain scientific, traditional and regional knowledge
12. Include related fields of social and natural science

- 5 operational guidance（abridged copy）

Guide2 Implementation for equity allocation of benefit

Guide3 Application of practicing of optimal management

Guide5 Save a mutually combination of sector

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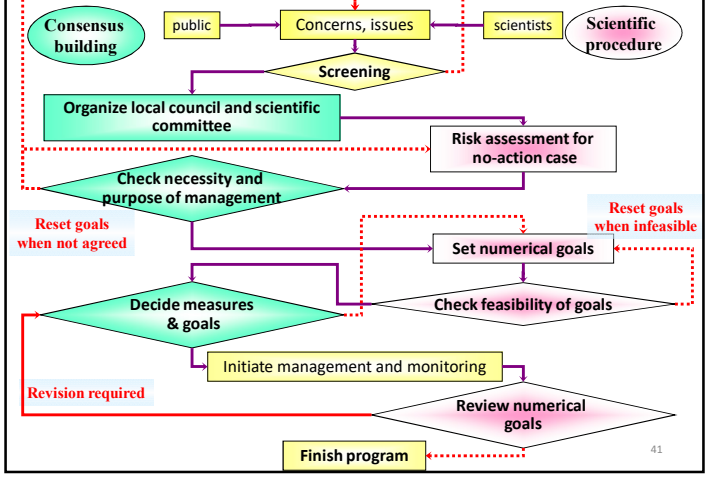
Flow diagram for ecological risk management
(Rossberg et al 2005 Landscape Ecology and Engineering)



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UN Framework Convention on Climate Change 1992

"Where there are threats of serious or ir-reversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost.

http://unfccc.int/

Science Diplomacy 科学(技術)外交

1. Informing foreign policy objectives with scientific advice (science in diplomacy)
2. Facilitating international science cooperation (diplomacy for science)
3. Using science cooperation to improve international relations between countries (science for diplomacy)

https://www.nap.edu/read/13300/chapter/4#27
http://www.mofa.go.jp/mofaj/press/release/press4_002096.html

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What is Regulatory Science?

- Mitsuru Uchiyama内山充(1987) proposed "regulatory science" as the science of optimizing scientific and technological developments according to objectives geared toward human health".
- Sheila Jasanoff (1990: The Fifth Branch) analyzed the concept of regulatory science, conducted for the purposes of meeting legally mandated standards, and the "boundary" drawing activities of science advisory committees.

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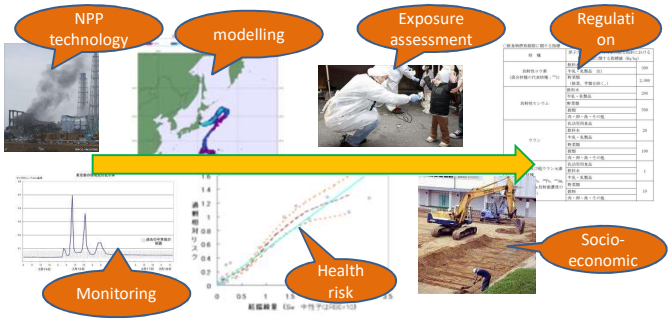
Regulatory science as an integrated knowledge

Revised after Atsuo Kishimoto

No expert knows everything… (in Fukushima disaster)



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Global Millennium Ecosystem Assessment (MA) scheme

Human Well-being
- Security
- Basic material…
- Health
- Good relationship…
- Freedom of choice..

Indirect DFs
- Demographic
- Economic
- Sociopolitical
- Cultural & Religious
- Science & Technology

Japan NSBAP*
1. Over-use
2. Under-use
3. Disturbance
- Climate Change

Direct DFs
A) Habitat change
B) Climate change
C) Invasive species
D) Over-exploitation
E) Pollution

Ecosystem S.
- Biodiversity
- Supporting S.
- Provisioning S.
- Regulating S.
- Cultural S.

*NSBAP=Nat'l Strategy for Biodiversity and Action Plan

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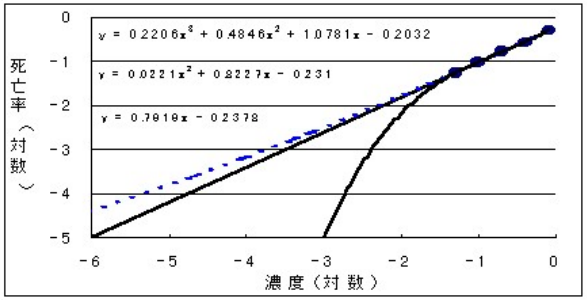
リスク評価の常とう手段

Extrapolation外挿（実証科学の禁じ手）

10万人に1人の死亡リスクは実証困難



リスク評価 46