Open Session Plan, ISAP Yokohama (Biofuels)
13 July 2010, 15:15-16:15, Main Venue (503)

オントロジーを用いたバイオ燃料問題の構造化と政策立案支援ツールの開発

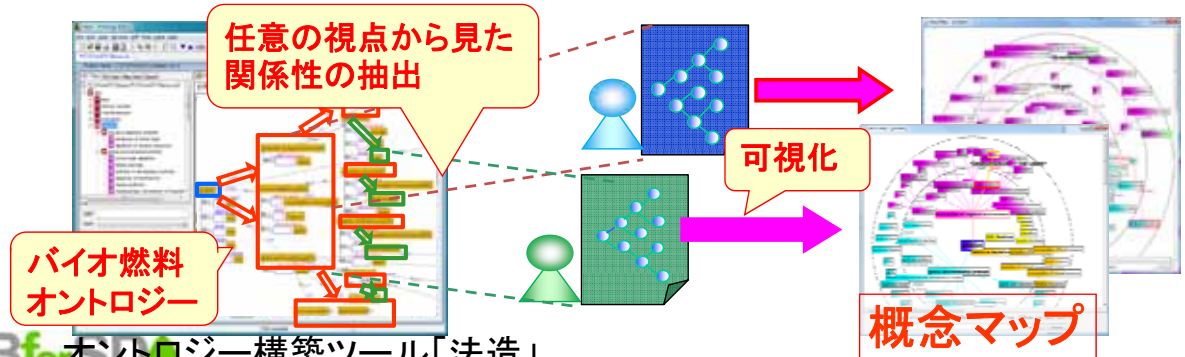
Development of the knowledge structuring and policy-making support tools for biofuel issues using ontological engineering

July 13, 2010

Saito, O. (Waseda University)
Mizoguchi, R., Kozaki(Osaka University)

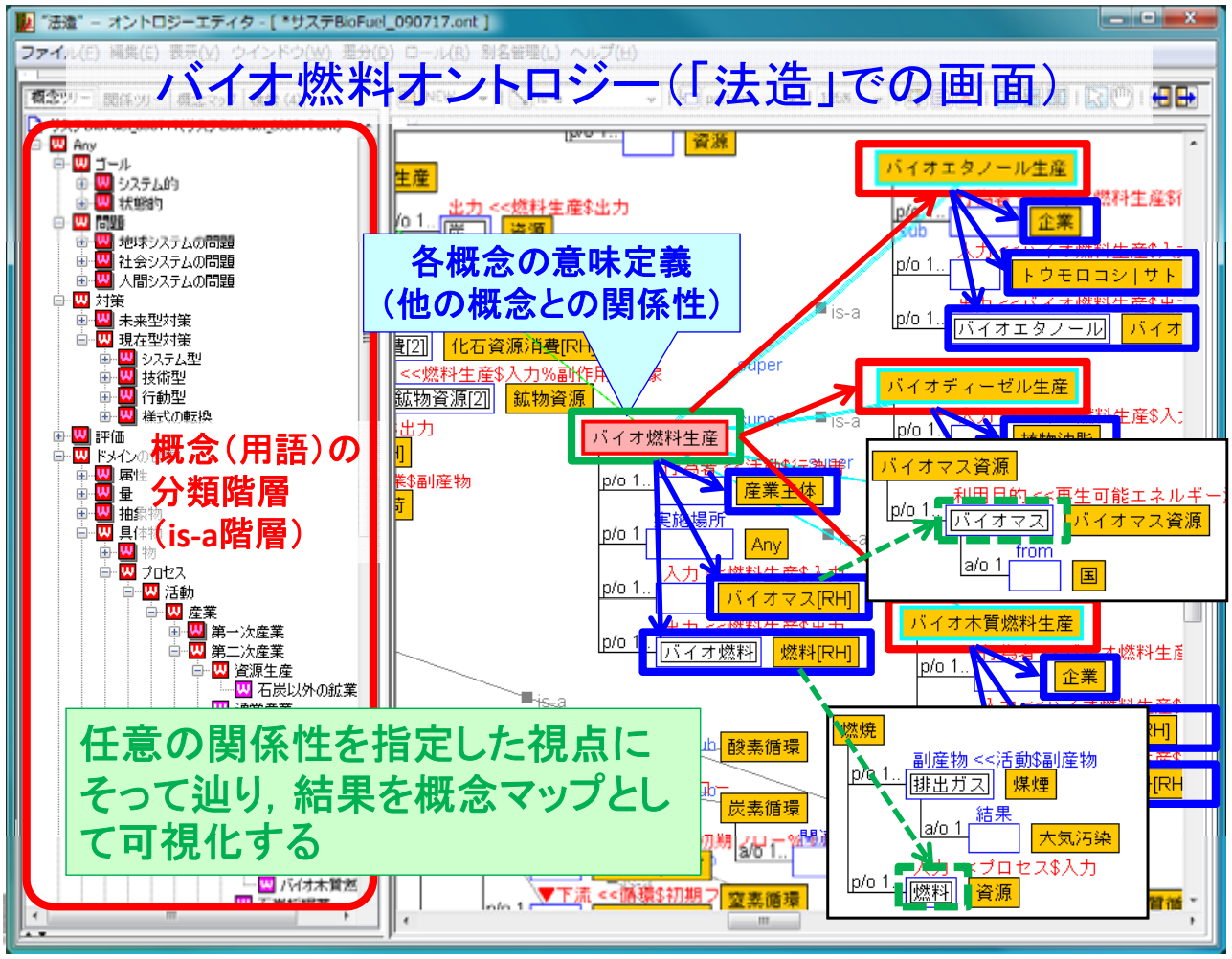
オントロジーに基づく複雑な問題の構造化

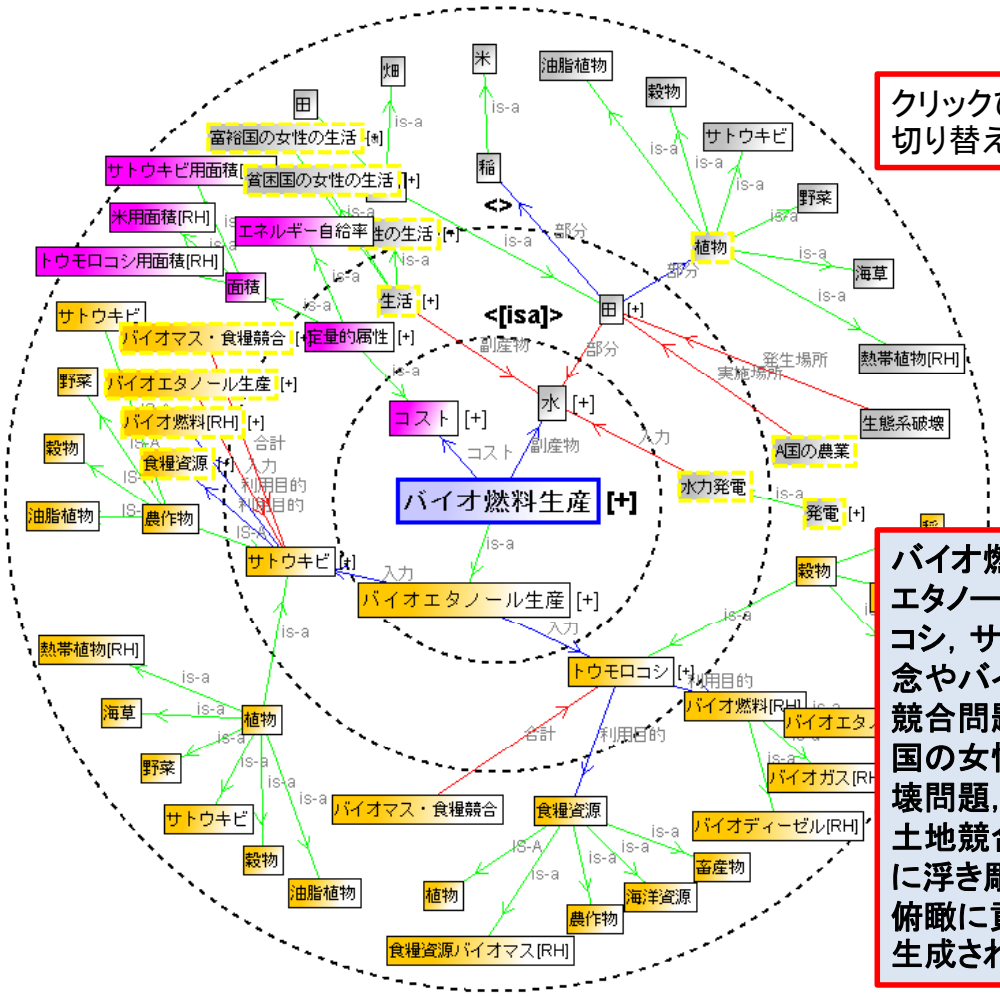
- オントロジーとは
  - 対象世界に現れる概念（用語）を計算機で意味処理可能な形で体系的に表したもの
- オントロジーを用いる効果
  - 概念の意味や関係性を一般性の高い形で明示することで，対象の深い理解や知識の相互運用に貢献する
  - 計算機で概念の「意味」を扱うことができる
- オントロジーに基づく問題領域の俯瞰ツール
  - 任意の視点から概念マップを生成し問題領域を俯瞰する



オントロジー構築ツール「法造」

バイオ燃料オントロジー（「法造」での画面）





クリックひとつで，英語版に切り替えることもできる

バイオ燃料生産からバイオエタノールを経て，トウモロコシ，サトウキビの関連概念やバイオマスと食糧の競合問題，水を介して貧困国の女性問題や生態系破壊問題，作付けに関わる土地競合問題などが同時に浮き彫りにされ，問題の俯瞰に貢献しうるマップが生成された．

バイオ燃料生産の正と負の影響のレビュー
Positive and negative effects of biofuel

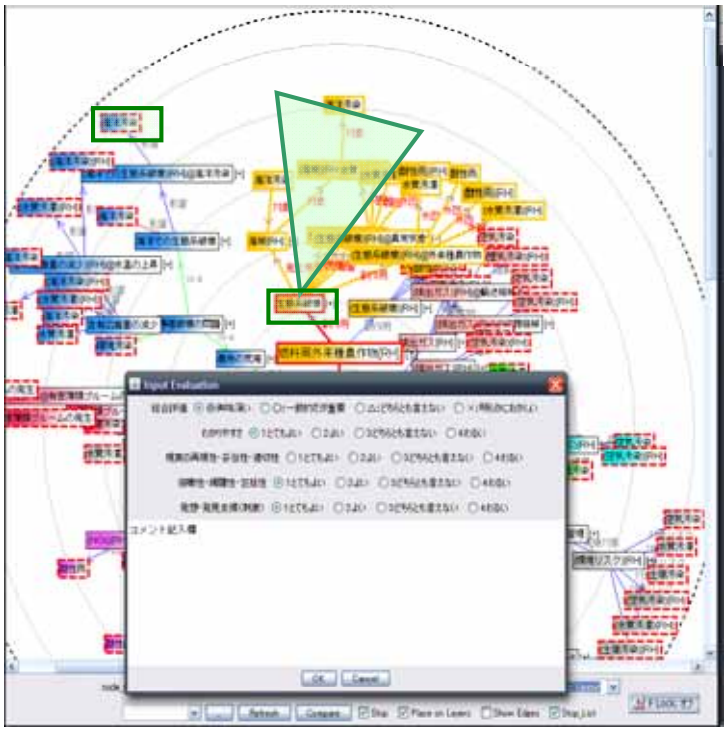
1) Energy services for the poor 貧困層へのエネルギーサービス供給	(+/−) Competition of biomass energy systems with the present use of biomass resources (such as agricultural residues) in applications such as animal feed and bedding, fertilizer, and construction materials[1] [illegible]mall-scale biomass energy projects face challenges obtaining finance from traditional financing (−) Liquid biofuels are likely to replace only a small share of global energy supplies and cannot alone eliminate our dependence on fossil fuels[2]
2) Agro-industrial development and job creation 農工業の発展と雇用の創出	(+) Biofuel is powering new small- and large-scale agro-industrial development and spawning new industries in industrialized and developing countries[1] (+/−) In the short-to-medium term, bioenergy use will depend heavily on feedstock costs and reliability of supply, cost and availability of competing energy sources, and government policy decisions[1] (+) In the long term, the economics of biofuel will probably improve as agricultural productivity and agro-industrial efficiency improve, [illegible]cultural and energy policies are adopted, carbon markets mature and expand, and new methodologies for carbon sequestration accounting are developed[1] (+) In the longer term, expanded demand and increased prices for agricultural commodities may represent opportunities for agricultural and rural development[2] (+) Biofuel industries create jobs, including highly skilled science, engineering, and business-related employment; medium-level technical staff; low-skill industrial plant jobs; and unskilled agricultural labor[1] (+/−) Small-scale and labor intensive production often lead to trade-offs between production efficiency and economic competitiveness[1]
3) Health and gender 健康とジェンダー	(−) Market opportunities cannot overcome existing social and institutional barriers to equitable growth, with exclusion factors such as gender, ethnicity, and political powerless, and may even worsen them[2] [illegible]Forest burning for development of feedstock plantation and sugarcane burning to facilitate manual harvesting result in air pollution, [illegible]igher surface water runoff, soil erosion, and unintended forest fires[3,4] (−) Exploitation of cheap labor (plantation and migrant workers)[4] (−) Increased use of pesticides could create health hazards for labors and communities living near areas of feedstock production[1,3]
4) Agricultural structure 農業の産業構造	(−) The demand for land to grow biofuel crops could put pressure on competing land usage for food crops, resulting in an increase in food prices[1,2] (+/−) Significant economies of scale can be gained from processing and distributing biofuels on a large scale. The transition to liquid [illegible]fuels can be harmful to farmers who do not own their own land, and to the rural and urban poor who are net buyers of food[1] [illegible]While global market forces could lead to new and stable income streams, they could also increase marginalization of poor and indigenous people and affect traditional ways of living if they end up driving small farmers without clear titles from their land and destroying their livelihood[1]

(+): Positive effects, (−): Negative effects, (+/−): Both positive and negative effects
(Source) 1: UN-Energy (2007), 2: FAO (2008), 3: CBD (2008), 4: Martinelli et al. (2008)

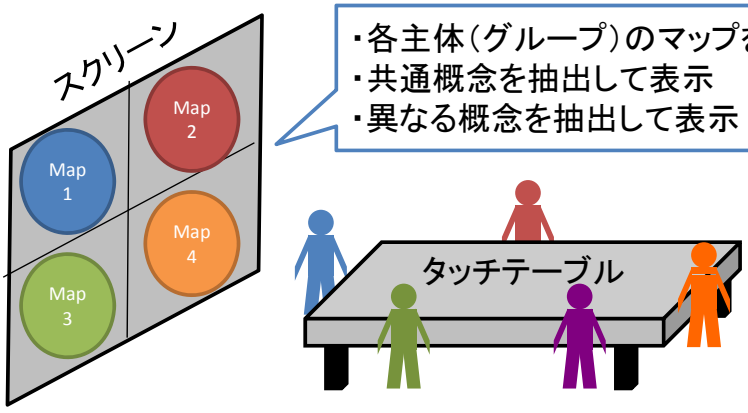
5) Food security 食料安全保障	(−) Demand for agricultural feedstock for liquid biofuels will be a significant factor for agricultural markets and world agriculture over the next decade and perhaps beyond[2] (−) Rapid growing demand for biofuel feedstock has contributed to higher food prices, which poses an immediate threat to the food security of poor net food buyers in both urban and rural areas[2] (+/−) The effect of biofuels on food security is context-specific, depending on the particular technology and country characteristics involved[1]
6) Government budget 政府予算	(−) Because ethanol is used largely as a substitute for gasoline, providing a large tax reduction for blending ethanol and gasoline reduces government revenue from this tax, mainly targeting the non-poor[1] (−) Production of biofuels in many countries, except sugarcane-based ethanol production in Brazil, is not currently economically viable without subsidies, given existing agricultural production and biofuel-processing technologies and recent relative prices of commodity feedstock and crude oil[2] (−) Policy intervention, especially in the form of subsidies and mandated blending of biofuels with fossil fuels, are driving the rush to liquid biofuels, which leads to high economic, social, and environmental costs in both developed and developing countries[2]
7) Trade, foreign exchange balance, and energy security 貿易，外国為替均衡	(+) Diversifying global fuel supplies could have beneficial effects on the global oil market and many developing countries because fossil fuel dependence has become a major risk for many developing economies[1] (+/−) Rapidly rising demand for ethanol has had an impact on the price of sugar and maize in recent years, bringing substantial rewards to [illegible]ot only in Brazil and the United States but around the world[1,2] [illegible]g of agricultural prices to the vicissitudes of the world oil market clearly presents risks; however, it is an essential transition to the development of a biofuel industry that does not rely on major food commodity crops[1]
8) Biodiversity and natural resource management 生物多様性，自然資源	(+/−) Depending on the types of crop grown, what they replaced, and the methods of cultivation and harvesting, biofuels can have negative and positive effects on land use, soil and water quality, and biodiversity[1,3] (−) Problems with water availability and use may represent a limitation on agricultural biofuel production[1,3] (−) Introduction of criteria, standards, and certification schemes for biofuels may generate indirect negative environmental and biodiversity effects, passively in other countries[3] [illegible]tion of biofuel feedstock requires increased fertilizer and pesticide use, there could be additional detrimental effects such [illegible]n GHGs emission and eutrophicating nutrients and biodiversity loss[3] (−) Wild biodiversity is threatened by loss of habitat when the area under crop production is expanded, whereas agricultural biodiversity is vulnerable in the case of large-scale monocropping, which is based on a narrow pool of genetic material, and can also lead to reduced use of traditional varieties[2,3] (+) If crops are grown on degraded or abandoned land, such as previously deforested areas or degraded crop- and grasslands, and if soil disturbances are minimized, feedstock production for biofuels can have a positive impact on biodiversity by restoring or conserving habitat and ecosystem function[3]
9) Climate change 気候変動	(+/−) Full lifecycle GHG emissions of biofuel vary widely based on land use changes, choice of feedstock, agricultural practices, refining or conversion processes, and end-use practices[1,2] (−) Land use change associated with production of biofuel feedstock can affect GHG emissions; draining wetlands and clearing land with fire are detrimental with regard to GHG emissions and air quality[2,3] (−) The greatest potential for reducing GHG emission comes from replacement of coal rather than petroleum fuels[1] (+) Biofuels offer the only realistic near-term renewable option for displacing and supplementing liquid transport fuels[1]

(+): Positive effects, (−): Negative effects, (+/−): Both positive and negative effects
(Source) 1: UN-Energy (2007), 2: FAO (2008), 3: CBD (2008), 4: Martinelli et al. (2008)

マップツールの専門家による利用実験・評価
Experimental expert workshop for application and evaluation of the tool

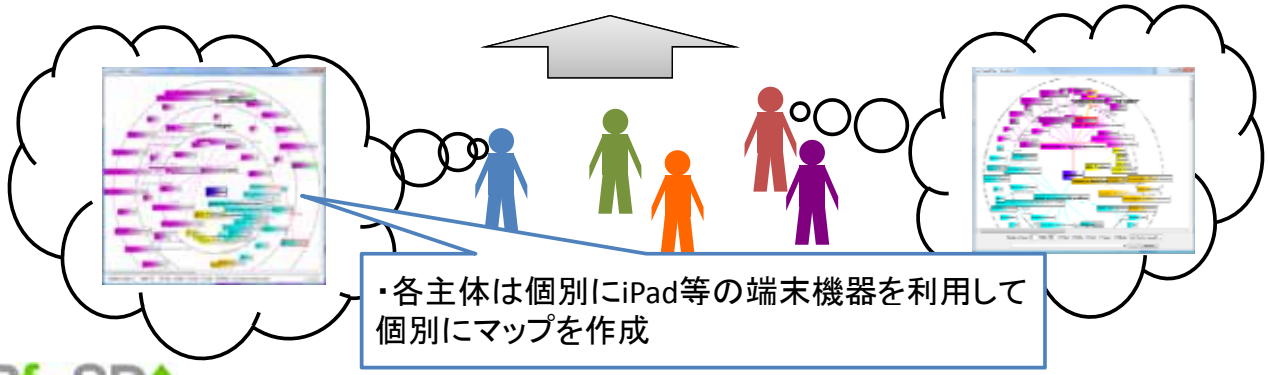


支援ツールの利用イメージ



・各主体（グループ）のマップを複数表示
・共通概念を抽出して表示
・異なる概念を抽出して表示

2nd Step: 集まって討議・ワークショップ



・各主体は個別にiPad等の端末機器を利用して個別にマップを作成

1nd Step: 個別の認識マップ作成