Food System Informatics:

From molecular to planetary …

From agricultural innovation to food system transformation

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UCDAVIS

AGRICULTURAL SUSTAINABILITY INSTITUTE

College of Agricultural and Environmental Sciences

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INFORMATION CENTER FOR THE ENVIRONMENT

College of Agricultural and Environmental Sciences

ASI: solutions for a sustainable food system

Our mission: *to ensure access to healthy food and to promote the vitality of agriculture today and for future generations.*

Note …
Entry points: food, health
Vision and commitment: empirically verifiable

Our vision is a food system that:

- *is innovative, adaptive and profitable*
- *provides healthy food for everyone*
- *promotes prosperity and equity for people working in agriculture and the food system and for their communities*
- *improves the environment and human health*
- *builds awareness and understanding of the food system*
- *engages public participation in policy decisions affecting food and agriculture*

Our commitment: *every farm, every ranch, and every community in California will be healthier in the future than it is today*

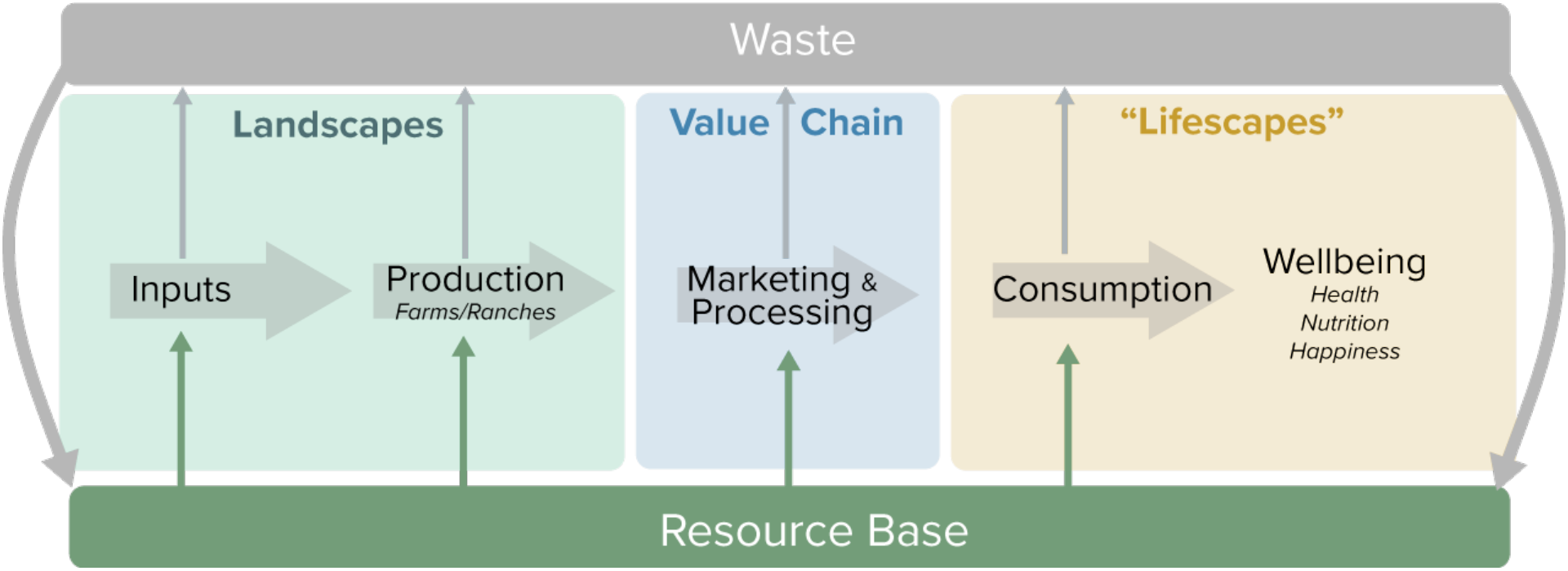
What do we mean by "food system"?

***One definition*:**

"the set of activities and relationships that interact to determine what, how much, by what method, and for whom food is produced and distributed."

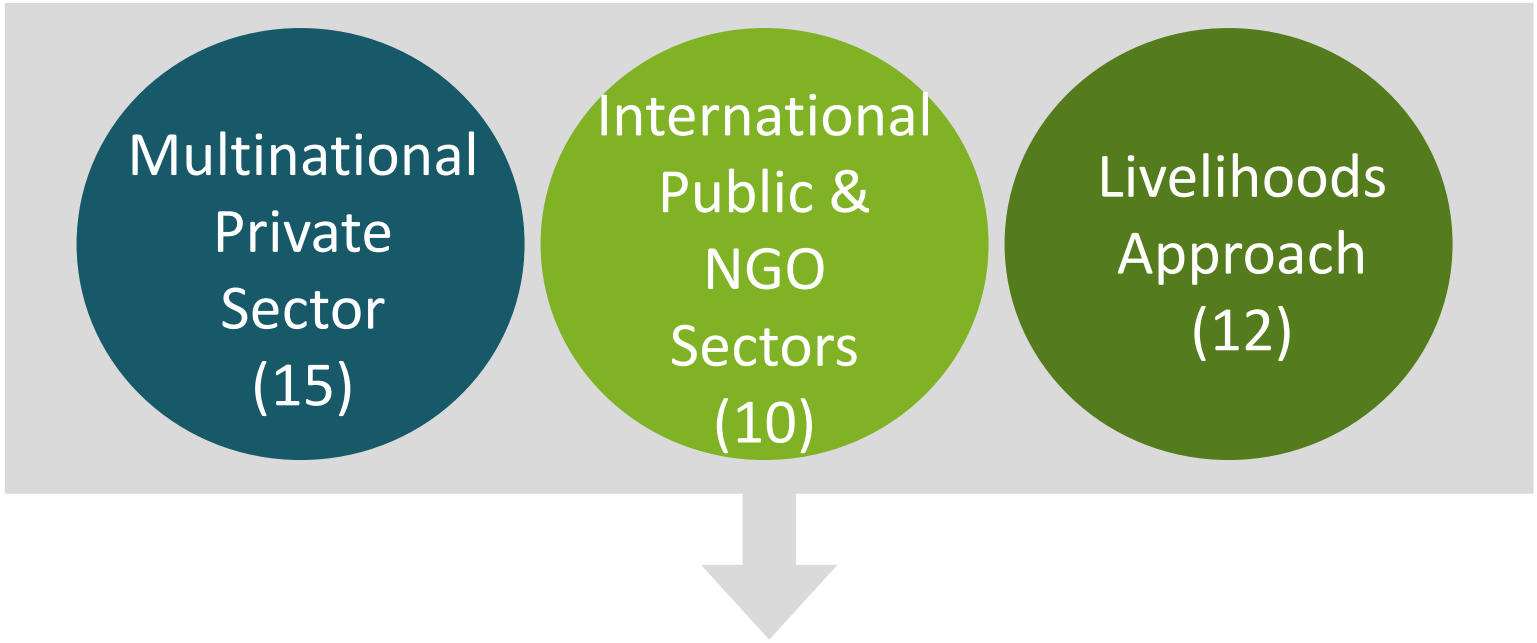
- Organization for Economic Cooperation and Development (OECD) 1981.

Food Systems Perspective
… opens options and reveals possibilities



Adapted and modified from a graphic by Michelle Grant, World Food Systems Centre, ETH Zurich

Sustainable Sourcing Graph Database



44 Integrated Issues of Sustainable Sourcing
6 Capital Groups
2000+ Indicators of Sustainable Sourcing

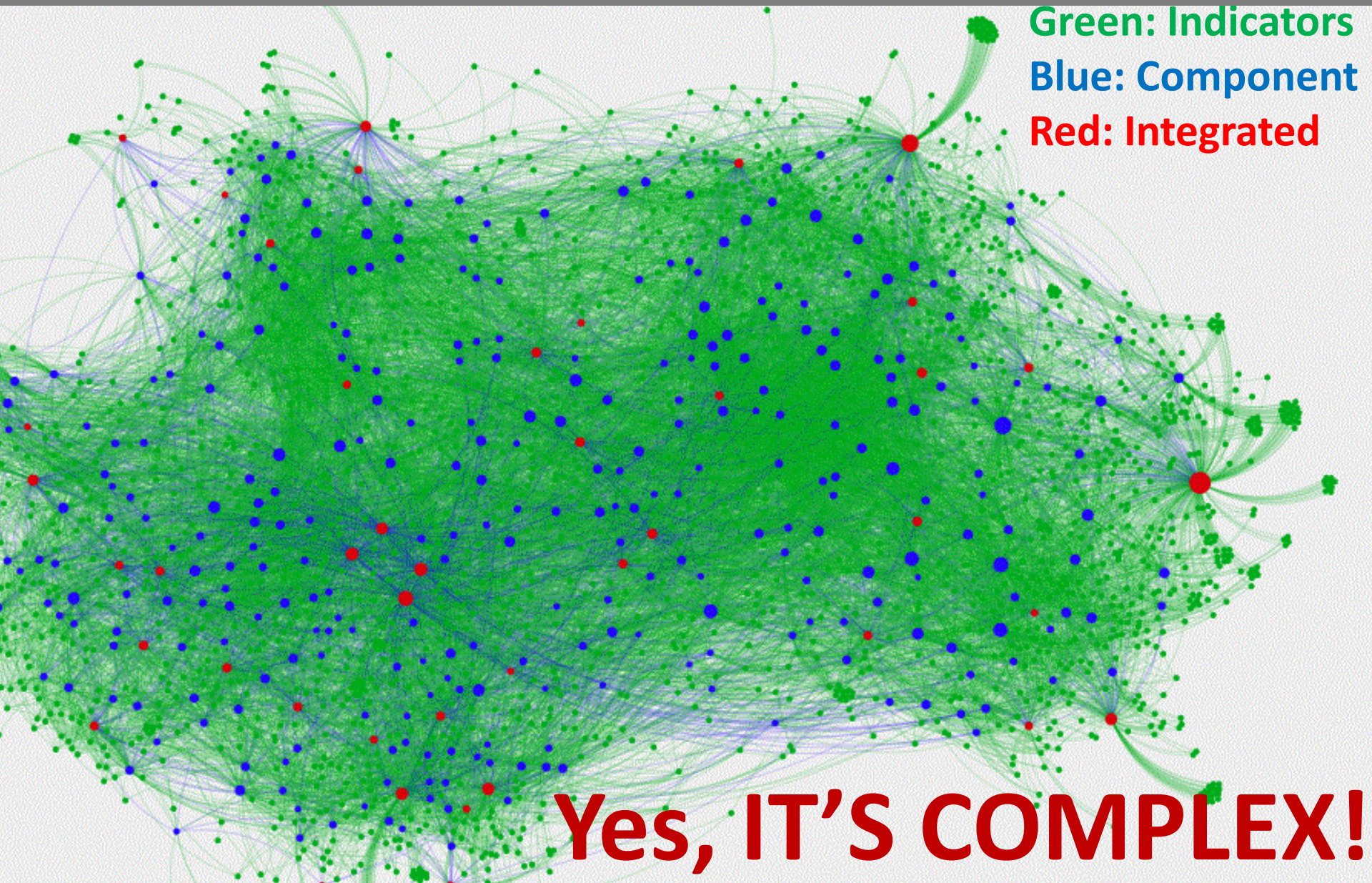
With significant support from Mars, Incorporated

Also Kraft Foods and ongoing interest from Barilla

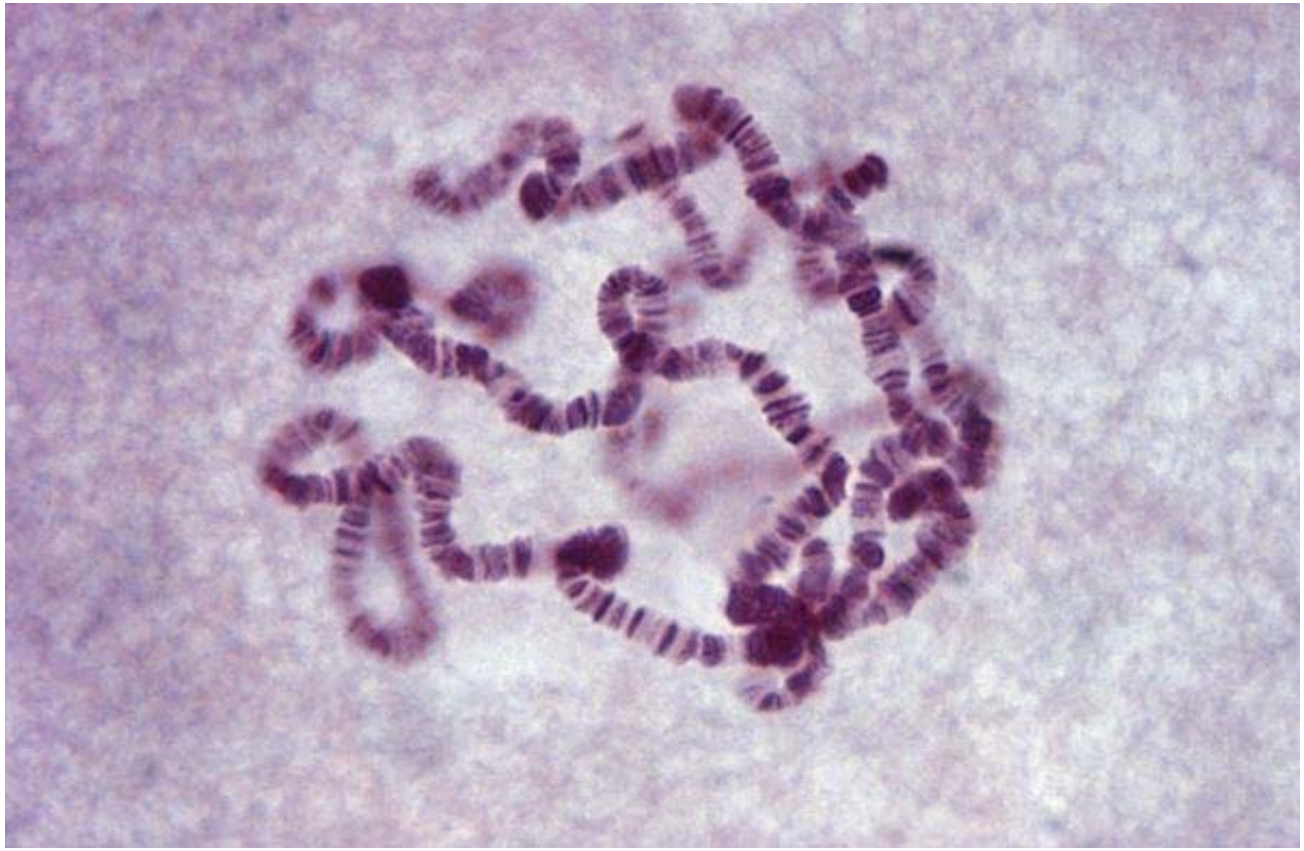
Mars, Incorporated vision for this work…

- Goal is to help stakeholders in the food industry make more sustainable decisions for sourcing of raw agricultural materials (from field to factory)
- Useful for any commodity in any location
- Open access: outputs reside in precompetitive space

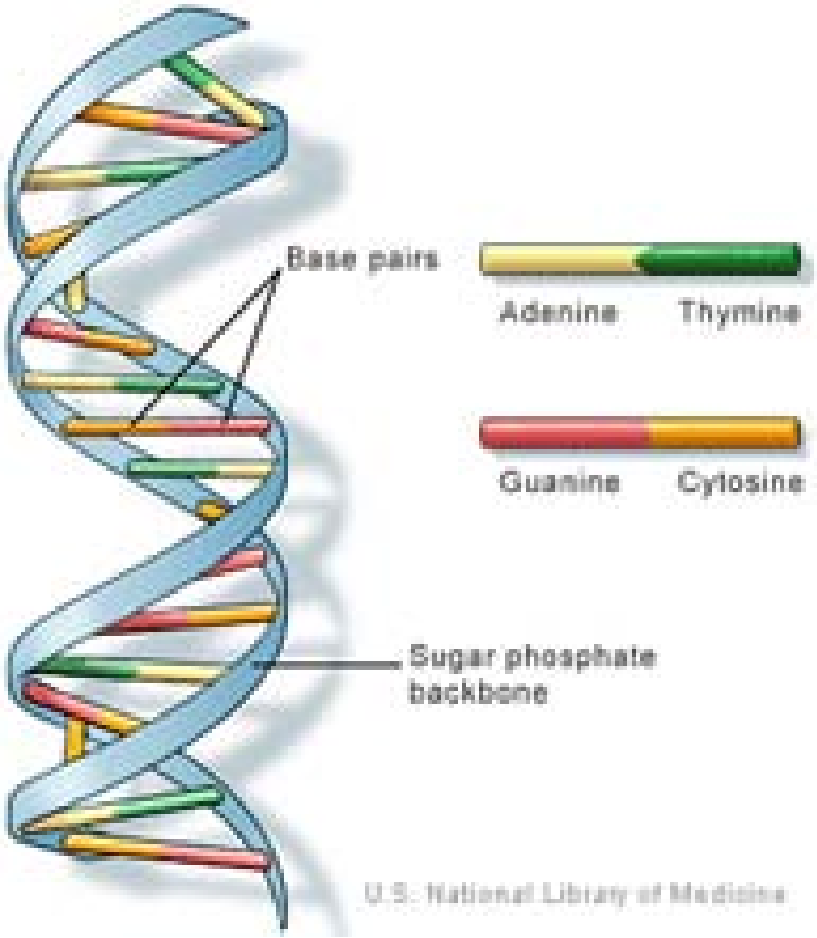
Graph database of issue-to-indicator linkages



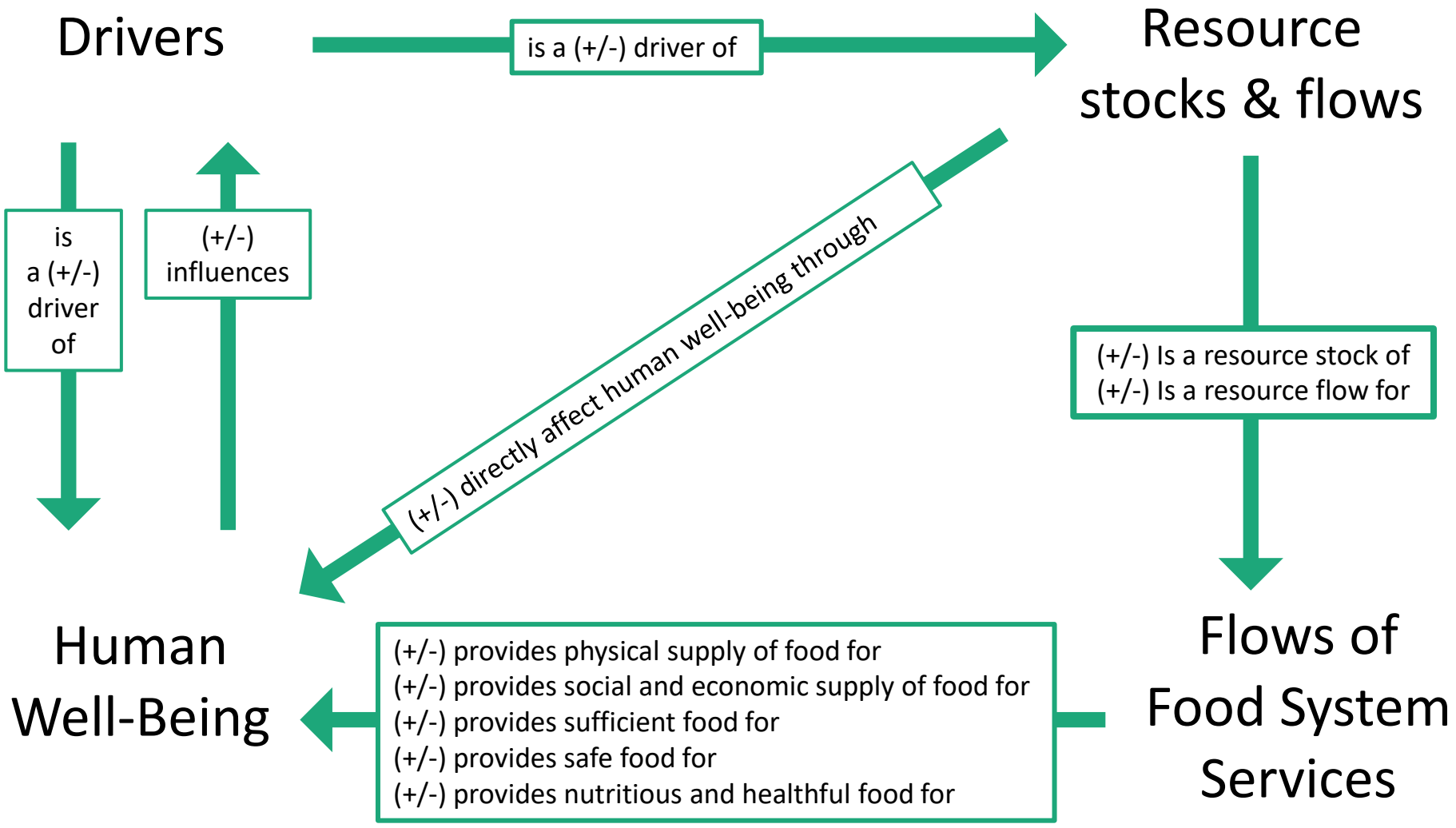
Molecular heuristics: consider DNA



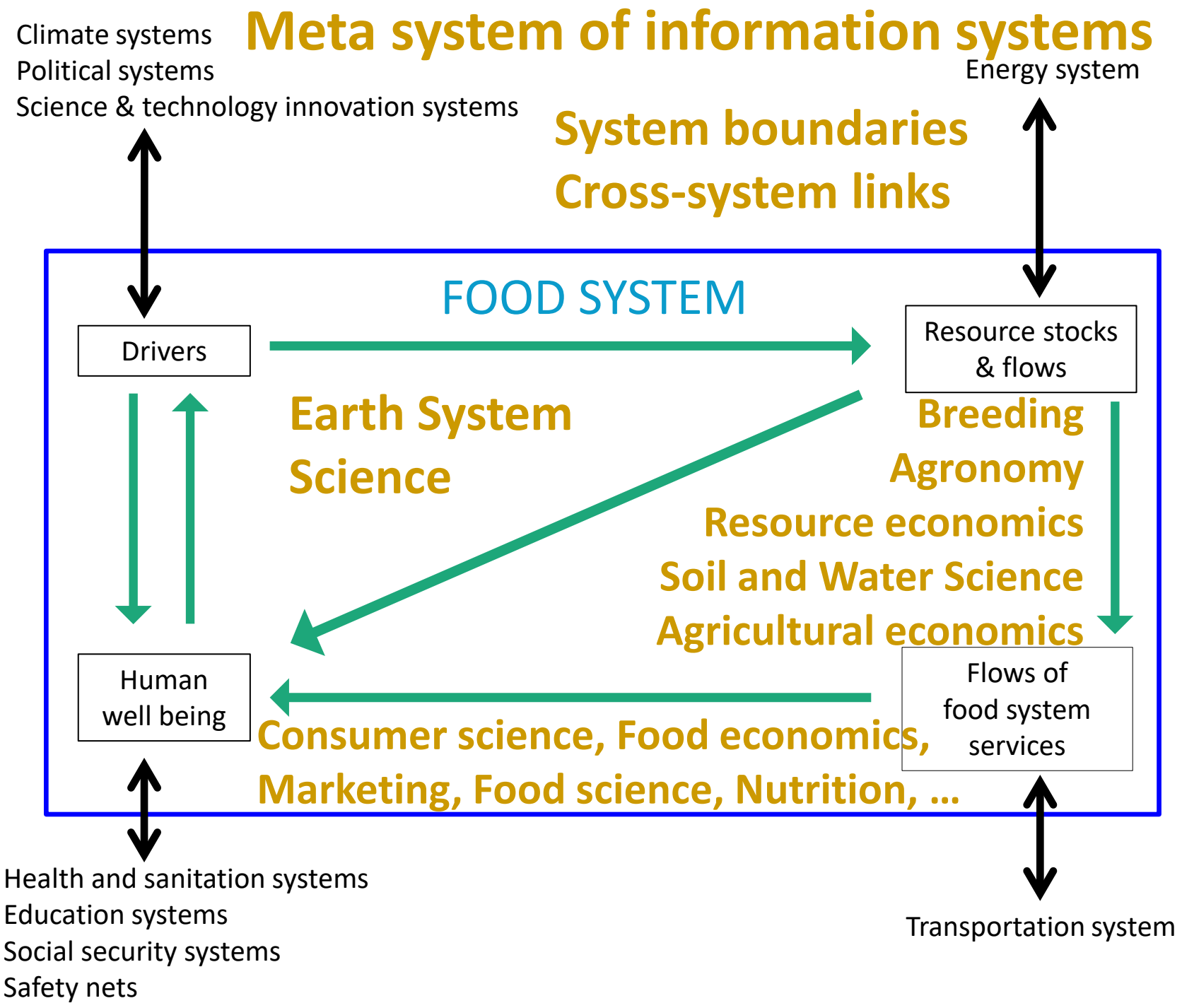
Source: *The New York Times*


Base pairs
Adenine
Thymine
Guanine
Cytosine
Sugar phosphate backbone
U.S. National Library of Medicine

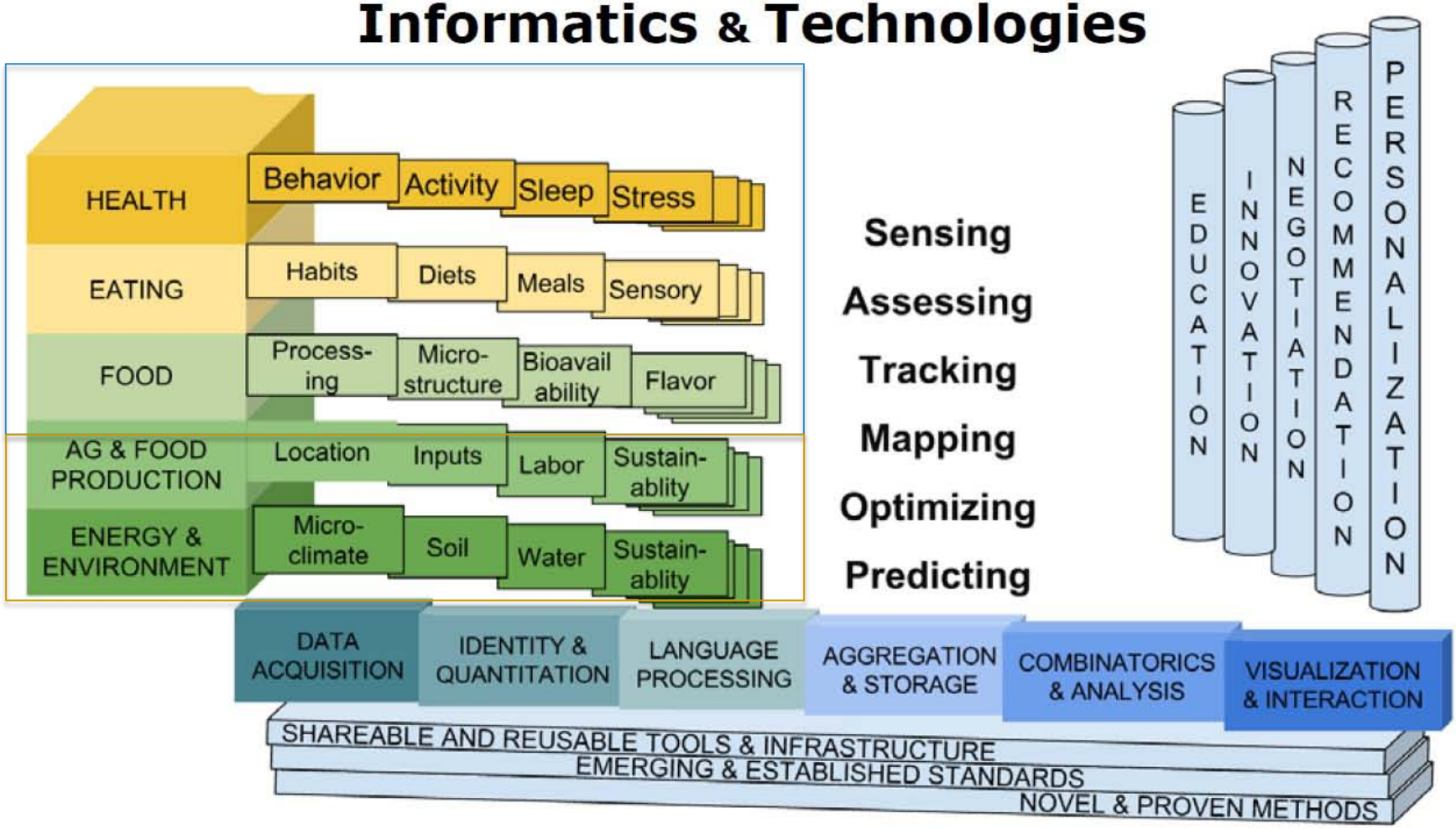
From base pairs to ontological triples (subject, predicate, object)



Food system informatics: ontologies = backbone, controlled vocabularies = building blocks


Meta system of information systems
Climate systems
Political systems
Science & technology innovation systems
Energy system
System boundaries
Cross-system links
FOOD SYSTEM
Drivers
Resource stocks & flows
Earth System Science
Breeding
Agronomy
Resource economics
Soil and Water Science
Agricultural economics
Human well being
Flows of food system services
Consumer science, Food economics,
Marketing, Food science, Nutrition, …
Health and sanitation systems
Education systems
Social security systems
Safety nets
Transportation system

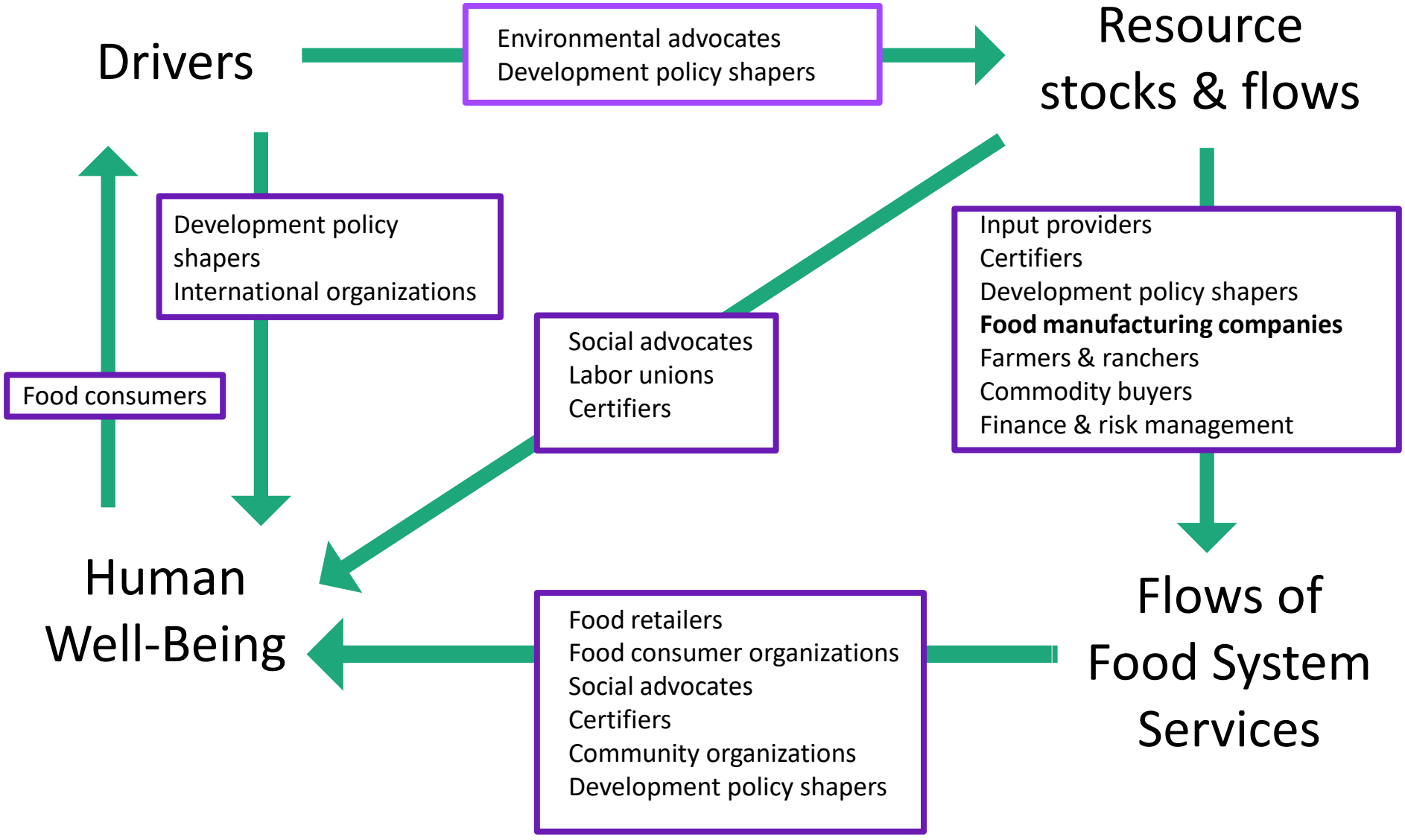
Food System Informatics & Technologies



Source: **Matthew Lange**, **IC-FOODS**, Dept of Food Science and Technology, UC Davis

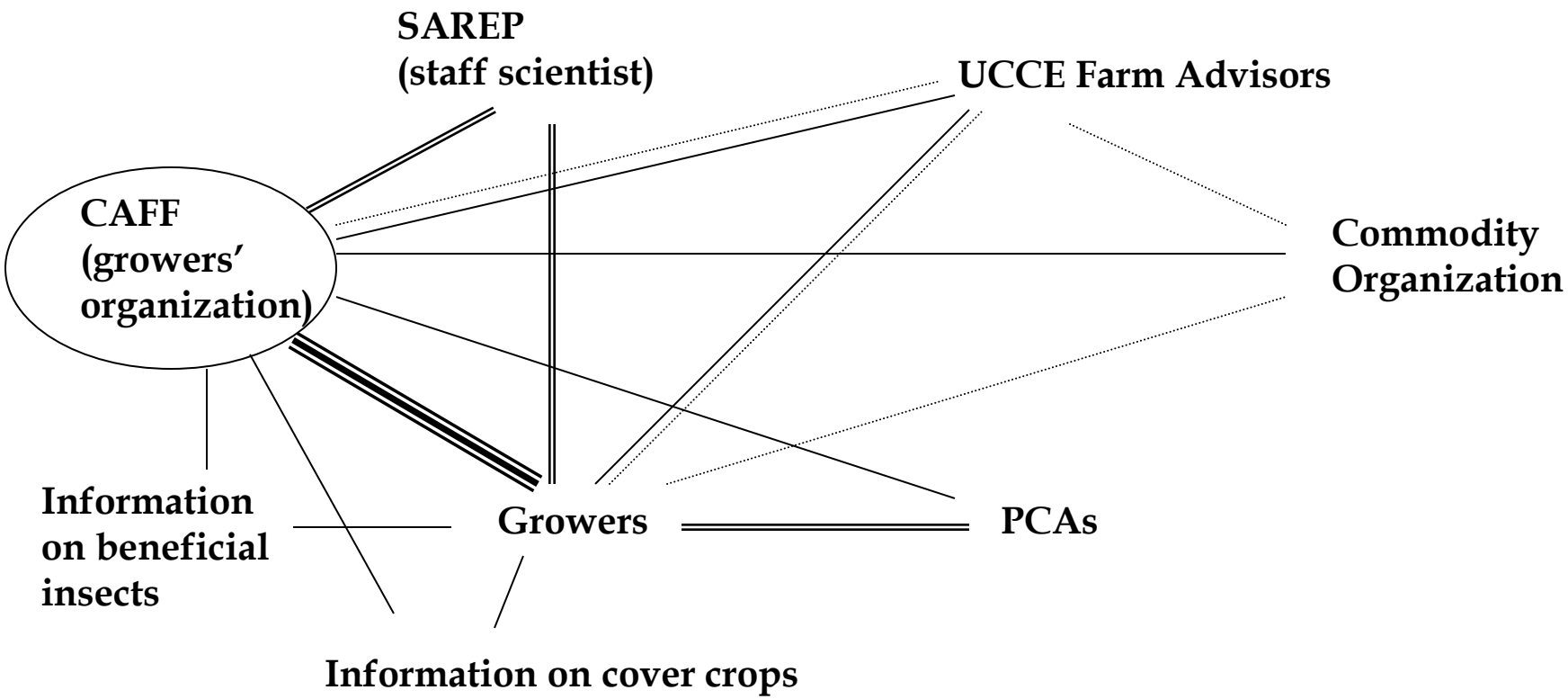
Food systems as social networks:

Structuring information on actors and relationships

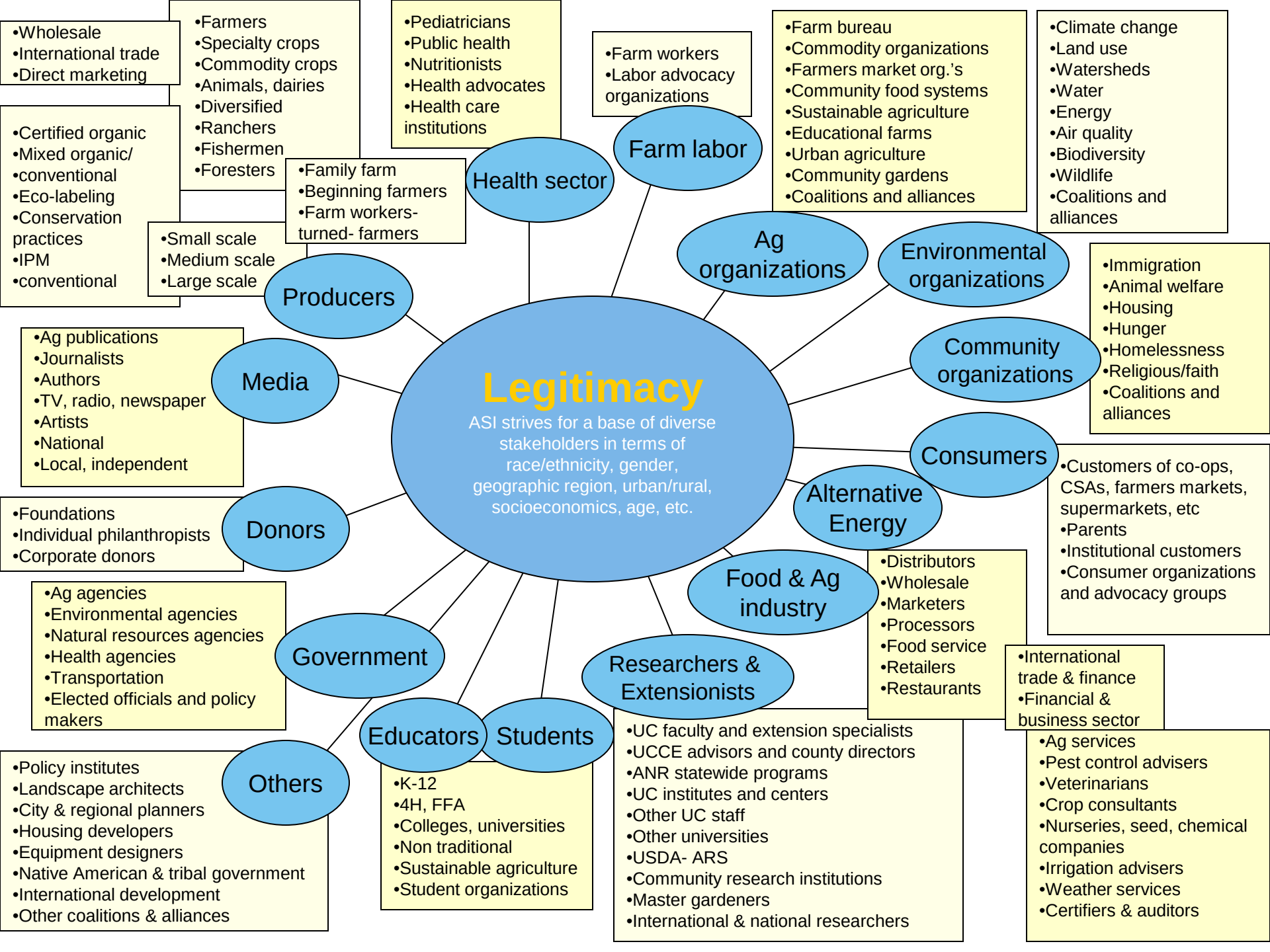


Ag innovation system model

Biologically Integrated Orchard Systems (Almonds)



Adapted from KD Warner, 2007 *Agroecology in Action*, p. 176


Legitimacy
ASI strives for a base of diverse stakeholders in terms of race/ethnicity, gender, geographic region, urban/rural, socioeconomics, age, etc.
Producers
•Small scale
•Medium scale
•Large scale
•Certified organic
•Mixed organic/ •conventional
•Eco-labeling
•Conservation practices
•IPM
•conventional
•Family farm
•Beginning farmers
•Farm workers-turned- farmers
•Farmers
•Specialty crops
•Commodity crops
•Animals, dairies
•Diversified
•Ranchers
•Fishermen
•Foresters
•Wholesale
•International trade
•Direct marketing
Health sector
•Pediatricians
•Public health
•Nutritionists
•Health advocates
•Health care institutions
Farm labor
•Farm workers
•Labor advocacy organizations
Ag organizations
•Farm bureau
•Commodity organizations
•Farmers market org.'s
•Community food systems
•Sustainable agriculture
•Educational farms
•Urban agriculture
•Community gardens
•Coalitions and alliances
Environmental organizations
•Climate change
•Land use
•Watersheds
•Water
•Energy
•Air quality
•Biodiversity
•Wildlife
•Coalitions and alliances
Community organizations
•Immigration
•Animal welfare
•Housing
•Hunger
•Homelessness
•Religious/faith
•Coalitions and alliances
Consumers
•Customers of co-ops, CSAs, farmers markets, supermarkets, etc
•Parents
•Institutional customers
•Consumer organizations and advocacy groups
Alternative Energy
Food & Ag industry
•Distributors
•Wholesale
•Marketers
•Processors
•Food service
•Retailers
•Restaurants
•International trade & finance
•Financial & business sector
Researchers & Extensionists
•UC faculty and extension specialists
•UCCE advisors and county directors
•ANR statewide programs
•UC institutes and centers
•Other UC staff
•Other universities
•USDA- ARS
•Community research institutions
•Master gardeners
•International & national researchers
Students
•K-12
•4H, FFA
•Colleges, universities
•Non traditional
•Sustainable agriculture
•Student organizations
Educators
Government
•Ag agencies
•Environmental agencies
•Natural resources agencies
•Health agencies
•Transportation
•Elected officials and policy makers
Others
•Policy institutes
•Landscape architects
•City & regional planners
•Housing developers
•Equipment designers
•Native American & tribal government
•International development
•Other coalitions & alliances
Donors
•Foundations
•Individual philanthropists
•Corporate donors
Media
•Ag publications
•Journalists
•Authors
•TV, radio, newspaper
•Artists
•National
•Local, independent
•Ag services
•Pest control advisers
•Veterinarians
•Crop consultants
•Nurseries, seed, chemical companies
•Irrigation advisers
•Weather services
•Certifiers & auditors

Publications

- **Springer et al. (2015)** Sustainable Sourcing of Global Agricultural Raw Materials: Assessing Gaps in Key Impact and Vulnerability Issues and Indicators. *PLOS One.*
- **Huber et al. (2015)** Indicators of global sustainable sourcing as a set covering problem: an integrated approach to sustainability. *Ecosystem Health and Sustainability* 1(2):7.

For background:

Clark et al. (2011). Boundary work in research programs for sustainable development: natural resource management at the Consultative Group on International Agricultural Research CGIAR. *PNAS* DOI 10.1073/pnas.0900231108