

SCIENCE COUNCIL OF THE CGIAR

Key research opportunities for the CGIAR

SC Secretariat, 30 June 2008

At ExCo-14 (May 2008) the SC agreed to prepare suggestions for improvement of the preliminary key research opportunities identified by Working Group 1 (Table 2, pg.20) of the CGIAR Change Management Process (CMP) in their Report to the Change Steering Team of the CGIAR of June 6, 2008.

This document includes general comments and three annexes: 1) suggestions to improve key research opportunities; 2) other suggestions to Table 2; and 3) mapping from the current CGIAR System Priorities (2005) to the recently identified strategic objectives.

General comments

1. **Annex 1:** Strategic objectives (SOs), themes and notional indicators (the first 3 columns of Table 2) are given as agreed by ExCo-14; on Annex 1 the SC has focused only on improving key research opportunities (column 4) based on the agreed SOs. Scope of research is indicated for each 'key research opportunity'. Please read **explanatory end notes to Annex 1** explaining the interpretation given to suggested key research opportunities.
2. As the key research opportunities presented here are discussed widely within the CGIAR community, it is important to note that from a research organization and implementation point of view the major challenge ahead lies in assembling and integrating key elements of these opportunities into a limited number of cohesive research initiatives that are likely to address simultaneously more than one strategic objective. That is, in developing concrete research proposals, single research activities may be targeting not just one objective, e.g., productivity improvement (SO1) but more likely several, e.g., environmental sustainability (SO2) and empowerment (SO3) at the same time. These must be looked at in an integrated context. The distinction between goals (strategic objectives) and instruments (germplasm improvement, NRM, policy) is useful to keep in mind.
3. **Annex 2:** Based on the SC adjustments to the key opportunities for research (Annex 1), the list of notional indicators given by the WG1 paper has been augmented, and additional suggestions made for generic statements of current major players, CGIAR advantages (including suggesting **whether CGIAR leads, partners or contributes**) and the key CGIAR functions for any particular research opportunity. However, the contents of the last three columns of Table 2 (columns 5, 6 and 7) can only be addressed in detail during the formulation of research proposals. It is still early to define a priori the nature and extent of the partnerships to be developed to implement a given research opportunity. A clear indication of the role that the CGIAR may play in the recommended research area; that is where the CGIAR will position itself as a leader or as a partner - should be developed as business models are clarified, as stated in section 7 (pg.24) of the Report of WG1.
4. The criteria to develop business models should include a clear definition of the research partnerships involved, as well as a more detailed definition of output indicators instead of the notional indicators currently mentioned in Table 2. This means critical interaction with Working Group 2 of the CMP will be necessary when defining and describing the nature and roles of the various partners.
5. **Annex 3:** relates the key research opportunities currently under discussion to the CGIAR System Priorities agreed in 2005.

ANNEX 1

SC Revised Key Research Opportunities

Comparing column 4 of Table 2 prepared by WG1 [left in black] with SC suggestions [right in blue]

Key Opportunities as defined in Table 2 (Preliminary Suggestions from WG1)	Key Research Opportunities (Suggestions from SC)
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Strategic Objective 1: Food for People

Create and accelerate sustainable increases in productivity and production of healthy food by and for the poor

Theme 1.a: Increased productivity

<p>Genetic improvement to push out the yield frontier.</p> <p>Genetic improvement in yield stability to abiotic and biotic stresses</p>	<p>Genetic improvement to enhance yield frontier</p> <p>This includes:</p> <p>Conservation for use (gene discovery)</p> <p>Improved yield stability of crop plants in the face of biotic and abiotic stresses [1]</p> <p>Improved resource use efficiency (water , nutrients)</p> <p>More resilience to pests through improved management of ecosystem and better plant health.</p> <p>Enhancing the sustainable production of livestock and fish from aquaculture (through genetic improvement and health management)</p> <p>Hybrid systems for major food crops</p> <p>Domestication and genetic improvement of indigenous tree crops [1]</p> <p>Institutional innovation and seed distribution systems</p>
<p>Development of a global commons of molecular tools and techniques to harness advanced science (including proprietary tools) for the poor</p>	<p>Development of a global commons of molecular tools and techniques to harness advanced science (including proprietary tools) for the poor [2]</p> <p>This includes:</p> <p>Assembling genetic resources for allele mining and genomic studies</p> <p>Linkages to frontier research (e.g. on photosynthesis, transpiration, apomixis and root biosphere)</p> <p>IP management</p> <p>Gene function through Networks (NARS) for phenotyping</p>

<p>Sustainable intensification through on-farm management and policy and institutional change (input systems, innovation systems, etc.) with a special focus on reducing fossil fuel use [3]</p>	<p>Sustainable intensification of farming systems through improved input efficiency</p> <p>This includes:</p> <p>Conservation management of resource base</p> <p>Understanding soil processes to improve resource base and use</p> <p>Improving water productivity in irrigated and rain-fed systems</p> <p>“Smart use” of inputs through decision support systems and simple rules</p> <p>Long term experiments and data acquisition in key sites in key production systems</p> <p>Institutional management and improved transfer of knowledge based management</p> <p>Policies for resource management of the catchment</p>
<p>Methods for empowering users in technology development and uptake, especially women [4]</p>	
<p>Development of improved livestock vaccines and other animal disease control technologies and methods [5]</p>	

Theme 1.b: Safe, Nutritious Food

<p>Biofortification of crop varieties</p>	<p>Biofortification of crop varieties</p> <p>This includes:</p> <p>Biofortification and research on dissemination of biofortified products</p> <p>Influence of soil nutrition on food nutrition</p>
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<p>Development of safer food systems and management practices (e.g. pesticides, aflatoxins)</p>	<p>Development of safer management practices in agriculture</p> <p>This includes:</p> <p>Integrated pest management and reduction in the misuse of pesticides</p> <p>Integrated approaches for reducing food-borne diseases such as aflatoxin.</p> <p>Strategies to reduce negative health impacts of waste water irrigation in agriculture</p> <p>Integrated management to minimize the incorporation or contamination of toxic substances in produce derived from livestock industries including aquaculture.</p> <p>Improving quality and safety of livestock through protection against zoonotic diseases.</p>
<p>More nutritious diets, to improve women’s and children’s health in particular and to improve food security</p>	<p>Diversification of production for improved nutrition</p> <p>This includes:</p> <p>Identification of “functional foods” and understanding adaptation in order to diversify farming systems (NARS activity) for improved diets and food security [6]</p>

Strategic Objective 2: Environments for People

Conserve, enhance and sustainably use natural resources and biodiversity to improve the livelihoods of the poor in response to climate change and other factors

Theme 2.a: Sustainable ecosystems and biodiversity conservation

<p>Augmentation, conservation, characterization and dissemination of germplasm collections of crops, indigenous livestock and aquatic animals</p>	<p>Augmentation, conservation, characterization and dissemination of germplasm collections of crops, forages, indigenous livestock and aquatic animals</p> <p>This includes:</p> <p>Enhancing collection to ensure global population/important gene coverage for target species and wild relatives;</p> <p>Phenotyping of key species for trait and gene discovery</p> <p>Contributing to global approaches, policy and strategies for in situ and ex situ conservation and use.</p>
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<p>Gender-responsive policies, institutions and technologies for sustainably managing land, water, pastures, forest and aquatic resources at ecosystem levels to deliver agricultural products and/or environmental services [7]</p>	<p>Enhancing technologies, policies, and institutions for sustainably managing land, water, pastures, forest and aquatic resources to deliver agricultural products and environmental services.</p> <p>This includes:</p> <p>Ensuring that the natural resource base for sustainable agriculture is maintained – including short term measures that ensure that transitory changes in agricultural product and energy prices, and land use do not jeopardize long-term use.</p> <p>Evaluate the multi-services used and provided by agriculture – to provide assessments of likely outcomes.</p> <p>Sustainable management of aquatic systems</p> <p>Integrated land, water and forest management at the landscape level</p> <p>Developing catchment and basin level models of resource use, including trade offs between objectives, for use by policy makers</p>
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Theme 2.b: Climate Change Mitigation and Adaptation

<p>Improving resilience of key at-risk ecosystems to shocks and ability to adapt to climate change</p>	<p>Improving resilience of key at-risk ecosystems to shocks and ability to adapt to climate change</p> <p>This includes:</p> <p>Documenting the risks to key food systems and mapping most vulnerable target domains</p> <p>Adaptive management strategies to respond to water and temperature stress including drought, rainfall variability and flooding.</p> <p>Development of integrated management options to improve future adaptation of farming, forestry and aquatic systems to climate change.</p>
<p>Institutional innovations for smallholders, both women and men, enabling them to access carbon sequestration funds and so reduce deforestation and improve soil management</p>	<p>Quantify trade-offs between food security, sustained livelihoods and the environment under climate change risk, and the effects of incentive schemes for the poor [8]</p> <p>This includes:</p> <p>Identification of policy arrangements which lead to reduction in emissions.</p> <p>Developing policies and institutional arrangements so that the rural poor can be net beneficiaries from environmental service schemes, particularly REDD payments.</p>

Technologies to reduce nitrous oxide and methane emissions from crops and livestock	<p>Manage farming and forest systems to mitigate the production of GHGs or other agents contributing to climate change [9]</p> <p>This includes:</p> <p>Examine tradeoffs of higher productivity per land area and increased gases</p> <p>Methods for assessing emissions and monitoring sequestration key to trading schemes.</p> <p>Decision support systems to increase N uptake by the plant and reduce N emissions</p> <p>Modeling and management of livestock systems (especially under intensification) in relation to GHG emissions.</p>
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Strategic Objective 3: Policies for People

Promote policy and institutional change that will stimulate agricultural growth and equity to benefit the poor, especially rural women and other disadvantaged groups

Theme 3.a: Policy and institutional innovation

Trade, price, and public investment policies	<p>Evaluation of trade, price and public investment policies as they affect pro-poor agriculture and equitable access to environmental services [10]</p> <p>This includes:</p> <p>Enhance capacity for trade-off modeling and the ability to forecast trends and issues affecting equitable outcomes</p> <p>Emphasis on science and technology policies (genetic resources access, certification, assessing efficacy of natural resource management policy, payment for services, benefit sharing).</p> <p>Improvement in the efficiency and equity of input markets, including seeds, fertilizer, pesticides, and labor.</p>
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Rural institutions and governance	<p>Enhancing rural institutions and governance for equitable agricultural production and sustained environmental services [11]</p> <p>This includes:</p> <p>Innovation in public-private partnerships for governance and the improved efficiency of rural institutions critical to agriculture and natural resources management in developing countries.</p> <p>Property rights affecting the poor, especially women, in terms of access to land, finance, water and other natural resources. [17]</p> <p>Comparative research on other governance issues, including decision-making structures and factors that contribute to regulatory enforcement.</p>
Institutional innovations to build assets and empowerment, with a special focus on women [12]	
Policy and institutional innovations to connect smallholders to markets and facilitate diversification	<p>Policy and institutional innovations to connect smallholders to markets and facilitate diversification</p> <p>This includes:</p> <p>Identification of high value products and opportunities for product markets accessible to small holders</p> <p>Research on producer organizations</p> <p>Identification of quality, food safety and other policy and institutional constraints</p> <p>Development of equitable policy options to encourage small-holder participation</p>

Theme 3.b: Gender Equity

Collection, monitoring, and analysis of gender-disaggregated data [13]	<p>Institutional innovation to build assets and empowerment, with a special focus on women in agriculture</p> <p>This includes:</p> <p>Enhanced studies on gender responsive policies and institutional improvement at different cultural and traditional socioeconomic environments, to promote women's access to the benefits of agricultural technological innovation</p>
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Mainstreaming of women's participation in agricultural innovation systems at global, national and local levels [14]	<p>Evaluation of gender-responsive policies for equitable access to and benefits from natural resources</p> <p>This includes e.g.</p> <p>Incorporating poverty and gender issues into policy and water management solutions</p>
Development of capacity to conduct and deliver gender-responsive research and leadership training for women agricultural scientists/ professionals/ extension workers [15]	
Research on gender issues in agriculture in different developing country contexts [16]	

Annex 1. Explanatory Notes	
1.	It would seem necessary to qualify crop plants as the WG1 paper focuses on staples but does not otherwise adequately distinguish the other aspects of agriculture. Rather, the WG1 paper uses a broad definition of agriculture (including livestock, fisheries and aquaculture and forests). However, the WG1 paper specifically appears to exclude improvement research on high value tree crops (such as coffee). The status of other non-timber forest products and plantation forestry is less clear in the WG1 document [and see Note 6].
2.	Tools and methods arise as part of the strategic approach to genetic improvement by the CGIAR and its practice with partners. It is not considered a research for development objective in its own right – rather it may be an output indicator – but the indicative activities are listed here temporarily.
3.	Fossil fuel use is just one element of sustainable intensification (and may be better thought of more generically as “energy” which affects other inputs too). Directions for priority research are best expressed through business plan.
4.	This opportunity placed under Gender (3b)
5.	Subsumed under the more generic opportunity for genetic and health improvements for livestock
6.	A rephrasing of this opportunity to understand how diversified diets will arise. The System Priorities for Research (SPs) placed emphasis on the exploitation of high-value products for income and pro-poor growth, rather than solely for nutrition. The WG1 suggests that the main focus on income and diversification via high value commodities would come through policies and institutional innovations rather than improvement activities (because the number of potential species is large). Thus the WG1 assessment is that the CGIAR could catalyse the private sector and ARIs to undertake the latter, rather than be the prime research mover. The WG1 paper does not elaborate on (i) the extent of research which might be undertaken on water management, rotations, IPM research and pesticide reduction in mixed farming systems, or (ii) on the relationship between IPGs and product line research by region.
7.	Reflected under Gender (3b)
8.	The WG1 statement seems to focus on several issues around payment schemes. Determining both the practicality and equitable administration of incentive schemes to achieve pro-poor benefits would seem to be part of a bigger research area. The SC has focused efforts on PES on REDD.
9.	A more general statement on research for mitigation that the CGIAR might undertake
10/11	Qualifying the direction of the research given generally
12.	Entered as an opportunity under Gender (3b).
13-16	Considered as sub-goals of a business plan (plan of action) that would be constructed in relation to more general opportunities under 3(b).
17	Several of the areas of research included under policy, (such as this research on land tenure), can also be viewed as contributing to a gender-focused portfolio (e.g. under 3b) but for simplicity the research is mentioned only once.

ANNEX 2

Other suggestions to improve Table 2

Using the SC adjustments to the key opportunities for research (from Annex 1) , some **notional indicators** are suggested with current major players, CGIAR advantages (including suggesting whether **CGIAR leads, partners or contributes**) and the key CGIAR functions for any particular research opportunity. The notional indicators are provided as an example only. They would need to be agreed and made more specific through the Change process. Similarly each of the other columns can only be completed at a very general (indicative) level currently.

WG1 Table 2 (**revised**): Strategic objectives, notional indicators (**revised**), key opportunities for research (revised as per Annex 1) and CGIAR advantages (**revised**)

Strategic objective	Themes	Notional indicators (for discussion/refinement)	Suggested key opportunities (for discussion)	Current major players (research/development partners)	CGIAR advantages (for discussion)	CGIAR functions that support key opportunities (for discussion)
Food for people 1. Create and accelerate sustainable increases in productivity and production of healthy food by and for the poor	Heartland: 1(a) Increased productivity <i>(Important ongoing work!)</i>	<ul style="list-style-type: none"> • Yield increases of food staples per unit of land and/or labor (by region) • Resource use efficiency (e.g. water, nutrients and fossil fuels) • Yield stability • Adoption of conservation tillage • More resilience to pests through management of biotic systems and plant health. • Development of improved livestock vaccines and other animal disease control technologies and methods • Genetic improvement of fish for aquaculture 	Genetic improvement to enhance yield frontier	CGIAR NARIs Private sector ARIs	CGIAR leads: Germplasm collection and gene mining Networks for phenotyping for gene function and for adaptation Understanding ecosystems Expertise in phenotyping Strong IPG Honest broker	Research Germplasm collection Catalyzing Networks Capacity development
			Development of a global commons of molecular tools and techniques to harness advanced science (including proprietary tools) for the poor	ARIs (incl. tech transfer agents) Private sector CGIAR	CGIAR contributes: Tools Project experience, practical cases of IP management Strong IPG Honest broker	Catalyzing Capacity

Strategic objective	Themes	Notional indicators (for discussion/refinement)	Suggested key opportunities (for discussion)	Current major players (research/development partners)	CGIAR advantages (for discussion)	CGIAR functions that support key opportunities (for discussion)
		<ul style="list-style-type: none"> A narrowing of gender disparities in the adoption of new technologies 	Sustainable intensification of farming systems through improved input efficiency	NARIs CGIAR NGOs	CGIAR contributes as partner: Systems perspective Long term trials (> 30 years) on sustainability Soil biotic processes and cycling Networks Policy expertise	Research Management of long term data sets Capacity Support to decision making
	New: 1(b) Safe, nutritious food (<i>Mainstreaming</i>)	<ul style="list-style-type: none"> Production of bio-fortified crops (Zn, Fe, Vitamin A) Reduced misuse of pesticides Incidence of food-borne diseases Incidence of zoonotic diseases Number of households achieving food security Number of women and children eating more nutritious diets Number of people (male, female by age group) eating more nutritious diet 	Biofortification of crop varieties	CGIAR ARIs Private sector International Agencies	CGIAR leads experimental approach in staples for the poor: Strong IPG Germplasm collection	Research Awareness raising Catalyzing exploratory research in delivery
			Development of safer management practices in agriculture	ARIs Private sector WHO FAO	CGIAR contributes research elements to international efforts in management: Integrated approaches for reducing food borne diseases such as aflatoxin Networks Strong IPG in some cases Integrated research approach to human health	Research Awareness raising Anticipation
			Diversification of production for improved nutrition	NGOs CGIAR NARIs Private sector (large and small)	CGIAR to establish farming diet linkages: Networks Policy expertise	Catalyzing Awareness raising Policy and support to decision making

Strategic objective	Themes	Notional indicators (for discussion/refinement)	Suggested key opportunities (for discussion)	Current major players (research/development partners)	CGIAR advantages (for discussion)	CGIAR functions that support key opportunities (for discussion)
<p><i>Environments for people</i></p> <p>2. Conserve, enhance and sustainably use natural resources and biodiversity to improve the livelihoods of the poor in response to climate change and other factors</p>	<p>Heartland: 2(a) Sustainable ecosystems and biodiversity conservation</p> <p><i>(Important ongoing work!)</i></p>	<ul style="list-style-type: none"> • Conservation and use of increased range of genetic resources and related information systems by public and private breeding programs • Increased latent diversity in cultivated species 	<p>Augmentation, conservation, characterization and dissemination of germplasm collections of crops, forages, indigenous livestock and aquatic animals</p>	<p>CGIAR</p> <p>GCDT</p> <p>FAO</p> <p>Other national and regional collections incl. UPGR and animals</p>	<p>CGIAR leads:</p> <p>Strong IPG</p> <p>Honest broker</p>	<p>Germplasm collection</p> <p>Research</p> <p>Catalyzing</p> <p>Policy for IPG transfer and use</p>
		<ul style="list-style-type: none"> • More ‘crop per drop’ trends in soil health and land degradation indicators at benchmark sites in at-risk agro-ecosystems • Improved water quality and quantity indicators at benchmark sites • Sustained productivity for key resource systems (fisheries, forests) • Improved gender equity in access to and control of benefits from natural resources • Long term trends identified from sustainability studies at key bench sites in at-risk ecosystems • Tested feasibility of PES approaches to assist the poor and sustain resources 	<p>Enhancing technologies, policies, and institutions for sustainably managing land, water, pastures, forest and aquatic resources to deliver agricultural products and environmental services.</p>	<p>Many players, global to local e.g.</p> <p>CGIAR</p> <p>NARIs</p> <p>Transboundary management bodies</p> <p>Water and irrigation agencies</p> <p>FAO</p> <p>IUCN, WWF</p> <p>Forestry Organizations</p> <p>Fisheries Management Organisations</p> <p>Co-sponsors and regional development banks</p>	<p>CGIAR contributes many types of research knowledge to national and intl. efforts:</p> <p>Networks</p> <p>Databases and models</p> <p>Long term studies</p>	<p>Integrative science and policy approaches</p> <p>Catalyzing agricultural and environmental science</p> <p>Models and equitable approaches for decision making</p> <p>Awareness and anticipation</p>

Strategic objective	Themes	Notional indicators (for discussion/refinement)	Suggested key opportunities (for discussion)	Current major players (research/development partners)	CGIAR advantages (for discussion)	CGIAR functions that support key opportunities (for discussion)
	New: 2(b) Climate change mitigation and adaptation (<i>New dimension!</i>)	<ul style="list-style-type: none"> • New crop varieties made available for adapting to climate change stresses • Numbers of smallholders participating in carbon financing programs for reducing deforestation • Land area and livestock covered by methane and nitrous oxide emissions reduction programs • Rate of deforestation attributed to land use changes (i.e. agriculture) • Impact assessment results of policies for promotion of conservation agricultural practices 	Improving resilience of key at-risk ecosystems to shocks and ability to adapt to climate change	Many players, global to local	CGIAR to partner with international community and national programs, providing: Germplasm Networks for adaptation studies Databases and models	Research Networks for adaptation studies Catalyzing Anticipation Awareness raising
			Quantify trade-offs between food security, sustained livelihoods and the environment under climate change risk, and the effects of incentive schemes for the poor [8]	International organizations NGOs Donor projects Support projects for PES and REDD	CGIAR contributes a range of inputs into pro-poor approaches: Forestry and land use expertise	Research Support to decision making Catalyzing
			Manage farming and forest systems to mitigate the production of GHGs or other agents contributing to climate change	ARIs CGIAR International Organizations NGOs	CGIAR contributes science to climate change community and local mitigation: Forest, crop and livestock expertise Conservation agriculture “Smart” input use	Research Catalyzing (linkage with Global climate change science community) Anticipation
Policies for people 3. Promote policy and institutional change that will stimulate agricultural growth and equity to benefit	Heartland: 3(a) Policy and institutional innovation (<i>Important ongoing work!</i>)	<ul style="list-style-type: none"> • Indices of policy distortions • Investments in core public goods (R&D, rural roads, water etc) as a share of agricultural GDP • National and rural governance indicators • Transactions cost (and 	Evaluation of trade, price and public investment policies as they affect pro-poor agriculture and equitable access to environmental services	MFI, OECD Sub-regional organizations National governments	CGIAR contributes specific elements to work of international organizations and national policy: Models Databases	Research Awareness raising Support to decision making

Strategic objective	Themes	Notional indicators (for discussion/refinement)	Suggested key opportunities (for discussion)	Current major players (research/development partners)	CGIAR advantages (for discussion)	CGIAR functions that support key opportunities (for discussion)
the poor, especially rural women and other disadvantaged groups		their reduction) in value chains <ul style="list-style-type: none"> • Impact assessment results of policies for food and nutrition security • Institutional innovation for producer organizations including small producers 	Enhancing rural institutions and governance for equitable agricultural production and sustained environmental services	MFIs, FAO CGIAR NARIS International NGOs	CGIAR contributes specific elements to work of international organizations and national policy: Networks Analysis capacity	Research Awareness raising Support to decision making
			Policy and institutional innovations to connect smallholders to markets and facilitate diversification	National governments Donor projects NGOs Private sector	CGIAR contributes specific elements of analysis to work of international organizations, national policy and private sector organizations: Expertise Databases	Research Support to policy and decision making Awareness raising
	New: 3(b) Gender equity <i>(New dimension!)</i>	<ul style="list-style-type: none"> • Increased availability of gender-disaggregated data for decision making in agriculture for CGIAR and partners • Increased number of women participating in agricultural science in CGIAR and partner 	Institutional innovation to build assets and empowerment, with a special focus on women in agriculture	International agencies NGOs CGIAR	CGIAR contributes specific elements of research and aids general awareness: Expertise Networks Databases	Support to decision making Awareness raising

Strategic objective	Themes	Notional indicators (for discussion/refinement)	Suggested key opportunities (for discussion)	Current major players (research/development partners)	CGIAR advantages (for discussion)	CGIAR functions that support key opportunities (for discussion)
		<p>institutions, and advancing to leadership positions</p> <ul style="list-style-type: none"> • Increased capacity and expertise to develop and implement gender- responsive agricultural innovations, especially for smallholders • Increased understanding of complex gender issues, risks, and opportunities in agriculture • Integration of gender-related indicators in CGIAR performance evaluation and reward systems (systemwide and leadership) 	<p>Evaluation of gender-responsive policies for equitable access to and benefits from natural resources</p>	<p>International agencies NGOs CGIAR Donor projects</p>	<p>CGIAR contributes specific elements of research and aids general awareness:</p> <p>Expertise Networks Databases</p>	<p>Catalyzing Awareness raising Support to decision making Capacity strengthening</p>

ANNEX 3

Mapping Key Research Opportunities to CGIAR SYSTEM PRIORITIES (2005)

Key Research Opportunities (Suggestions from SC)	SC Mapping to existing descriptions of research
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Strategic Objective 1: Food for People

Create and accelerate sustainable increases in productivity and production of healthy food by and for the poor

Theme 1.a: Increased productivity

Genetic improvement to enhance yield frontier This includes:	
Conservation for use (gene discovery)	<i>2A - Specific goal 1: Enhance the capacity and efficiency of genetic improvement programs through approaches linking characterization and use.</i>
Improved yield stability of crop plants in the face of biotic and abiotic stresses [1]	<i>As above plus 2B -Gen goal: To enhance the tolerance of crop species to selected abiotic stresses, plus 4D specific goal 4 on the production potential of high-productivity systems</i>
Improved resource use efficiency (water , nutrients)	<i>2A - Specific goal 2: Identification and development of pro-poor traits in crops (and footnote 12). 4C – Specific goal 1: Improve management practices that enhance the productivity of water 4D – Specific goals 1-3 on degradation thresholds, livestock/pastures and soil productivity.</i>
More resilience to pests through improved management of ecosystem and better plant health.	<i>4D – Specific goals 5,6, 7 and 8 on management of soil quality, biodiversity and IPM, landscape optimization and socio-economic factors for better natural resources management.</i>
Enhancing the sustainable production of livestock and fish from aquaculture (through genetic improvement and health management)	<i>2D – Specific goals 3 (genetic enhancement of livestock) and 4 (genetic enhancement of fish strains for aquaculture), and 3B Gen. goal to augment productivity and sustainability of livestock enterprises and 3C Gen. goal Increasing the supply of aquatic resources.</i>
Hybrid systems for major food crops <i>[Comment: Requires new elaboration of research and related activities.]</i>	

Domestication and genetic improvement of indigenous tree crops	<i>2D – Specific goal 2 (development improved germplasm of selected non-timber forest products)</i>
Institutional innovation and seed distribution systems <i>[Comment: Requires new elaboration of research and related activities.]</i>	
Development of a global commons of molecular tools and techniques to harness advanced science (including proprietary tools) for the poor [2] This includes:	
Assembling genetic resources for allele mining and genomic studies	<i>2A - Specific goal 1: Enhance the capacity and efficiency of genetic improvement programs through approaches linking characterization and use.</i>
Linkages to frontier research (e.g. on photosynthesis, transpiration, apomixis and root biosphere) <i>[Comment: Requires new elaboration of goals for research, ARI partnerships].</i>	
IP management <i>[Comment: Both project-specific and CGIAR-wide experience to be gained]</i>	
Gene function through Networks (NARES) for phenotyping	<i>Also foreseen under 2A - Specific goal 1: and “scope of research” for 2B</i>
Sustainable intensification of farming systems through improved input efficiency This includes:	
Conservation management of resource base	<i>4D – Specific goal 3, on domains of potential adoption and improvement of technologies for improving soil productivity.</i>
Understanding soil processes to improve resource base and use	<i>4D – Specific goal 5, on improving soil quality.</i>
Improving water productivity in irrigated and rain-fed systems	<i>4C – the General goal of this SP and specific goal 1</i>
“Smart use” of inputs through decision support systems and simple rules	<i>4D – Specific goal 6, on models and decision support systems</i>
Long term experiments and data acquisition in key sites in key production systems <i>[Comment: An approach rather than a research goal but underpins the framing of research in this area.]</i>	
Institutional management and improved transfer of knowledge based management <i>[Comment: An approach rather than a research goal but underpins the framing of research in this area.]</i>	
Policies for resource management of the catchment	<i>4D – Specific goal 7, on spatial and temporal management (allied to 4C - specific goal 3, on water focused policies and institutions)</i>

Theme 1.b: Safe, Nutritious Food

<p>Biofortification of crop varieties</p> <p>This includes:</p>	
<p>Biofortification and research on dissemination of biofortified products</p>	<p><i>2C - specific goals 1 and 2</i></p>
<p>Influence of soil nutrition on food nutrition <i>[Comment: Requires new elaboration of research and related activities.]</i></p>	
<p>Development of safer management practices in agriculture</p> <p>This includes:</p>	
<p>Integrated pest management and reduction in the misuse of pesticides</p>	<p><i>Foreseen within 4D - Specific goal 6: Design methods to manage and enhance biodiversity to increase income, reduce risk and vulnerability through integrated pest management (IPM), crop diversification (and rotations), and genetic diversity within crop species. However, may need to revisit planning horizon for this work.</i></p>
<p>Integrated approaches for reducing food-borne diseases such as aflatoxin.</p>	<p><i>2C - Specific goal 3: To reduce the content of constitutive or microbial toxins in selected staples that affect quality, food safety and human health.</i></p>
<p>Strategies to reduce negative health impacts of waste water irrigation in agriculture.</p>	<p><i>4C – Specific goal 2: Enhance the sustainable development of water resources – in relation to the appropriate use of marginal water.</i></p>
<p>Integrated management to minimize the incorporation or contamination of toxic substances in produce derived from livestock industries including aquaculture.</p>	<p><i>3B specific goals 1 and 2: in relation to bio-safety aspects of livestock production and the management of intensification.</i> <i>3C – specific goals 1 and 2: in relation to appropriate technological options for aquaculture and institutions and policies to meet fish and food safety requirements.</i></p>
<p>Improving quality and safety of livestock through protection against zoonotic diseases.</p>	<p><i>3B specific goals 1 and 2: in relation to diagnostic tools and epidemiology for animal health and definition of the impact of changing animal disease patterns on human health.</i></p>
<p>Diversification of production for improved nutrition</p> <p>This includes:</p>	
<p>Identification of “functional foods” and understanding adaptation in order to diversify farming systems (NARES activity) for improved diets and food security [6]</p>	<p><i>Foreseen under SP 3A but focus will need replanning on nutritional, food security aspects and approaches to farm level diversification research to be determined.</i></p>

Strategic Objective 2: Environments for People

Conserve, enhance and sustainably use natural resources and biodiversity to improve the livelihoods of the poor in response to climate change and other factors

Theme 2.a: Sustainable ecosystems and biodiversity conservation

<p>Augmentation, conservation, characterization and dissemination of germplasm collections of crops, forages, indigenous livestock and aquatic animals</p> <p>This includes:</p>	<p><i>Encompassed by SPs 1A (staples), 1B (under-utilized species), 1C (livestock) and 1D (fish for aquaculture)</i></p>
<p>Enhancing collection to ensure global population/important gene coverage for target species and wild relatives; <i>[Comment: Generic research which will be teased out according to species /commodity groups]</i></p>	
<p>Phenotyping of key species for trait and gene discovery <i>[Comment: Generic research which will be teased out according to species /commodity groups]</i></p>	
<p>Contributing to global approaches, policy and strategies for in situ and ex situ conservation and use. <i>[Comment: Generic research which will be teased out according to species /commodity groups]</i></p>	
<p>Enhancing technologies, policies, and institutions for sustainably managing land, water, pastures, forest and aquatic resources to deliver agricultural products and environmental services.</p> <p>This includes:</p>	
<p>Ensuring that the natural resource base for sustainable agriculture is maintained – including short term measures that ensure that transitory changes in agricultural product and energy prices, and land use to not jeopardize long-term use. <i>[Comment: New research required on short term responses to altered land use and land use policy in relation to prices and other trends.]</i></p>	
<p>Evaluate the multi-services used and provided by agriculture – to provide assessments of likely outcomes.</p>	<p><i>4A - Specific goal 1: To develop analytical methods and tools for the management of multiple use landscapes with a focus on sustainable productivity enhancement.</i></p>
<p>Sustainable management of aquatic systems</p>	<p><i>4B – General goal: Sustaining and managing aquatic ecosystems for food and livelihoods</i></p>
<p>Improving water productivity</p>	<p><i>4C– General goal: Improving water productivity</i></p>
<p>Integrated land, water and forest management at the landscape level</p>	<p><i>4A - Specific goals 2-5: on participation, effective rights to forests, optimization of water resources at the basin level and intersectoral management.</i></p>
<p>Developing catchment and basin level models of resource use, including trade offs between objectives, for use by policy makers</p>	<p><i>4A and 4C - specific goal 3 on improved water-focused policies and institutions</i></p>

Theme 2.b: Climate Change Mitigation and Adaptation

<p>Improving resilience of key at-risk ecosystems to shocks and ability to adapt to climate change</p> <p>This includes:</p>	
<p>Documenting the risks to key food systems and mapping most vulnerable target domains</p>	<p><i>CCCP theme 1: Diagnosing vulnerability and analyzing options</i></p>
<p>Adaptive management strategies to respond to water and temperature stress including drought, rainfall variability and flooding.</p>	<p><i>Interaction with 2B, Tolerance to selected abiotic stresses, but several areas of new research to be developed.</i></p>
<p>Development of integrated management options to improve future adaptation of farming, forestry and aquatic systems to climate change.</p>	<p><i>CCCP theme 4: Adaptation pathways based on managing current climate risk, and, CCCP theme 5: Adaptation pathways under progressive climate change</i></p>
<p>Quantify trade-offs between food security, sustained livelihoods and the environment under climate change risk, and the effects of incentive schemes for the poor [8]</p> <p>This includes:</p>	
<p>Identification of policy arrangements which lead to reduction in emissions. <i>[Comment: New area of CGIAR research to be developed]</i></p>	
<p>Developing policies and institutional arrangements so that the rural poor can be net beneficiaries from environmental service schemes, particularly REDD payments. <i>[Comment: New area of CGIAR research to be developed]</i></p>	
<p>Manage farming and forest systems to mitigate the production of GHGs or other agents contributing to climate change [9]</p> <p>This includes:</p>	<p><i>Generally relates to CCCP theme 1: Diagnosing vulnerability and analyzing options, but research still to be developed.</i></p>
<p>Examine tradeoffs of higher productivity per land area and increased gases <i>[Comment: New area of CGIAR research to be developed]</i></p>	
<p>Methods for assessing emissions and monitoring sequestration key to trading schemes. <i>[Comment: New area of CGIAR research to be developed]</i></p>	
<p>Decision support systems to increase N uptake by the plant and reduce N emissions <i>[Comment: New area of CGIAR research to be developed]</i></p>	

Modeling and management of livestock systems (especially under intensification) in relation to GHG emissions. <i>[Comment: New area of CGIAR research to be developed]</i>	
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Strategic Objective 3: Policies for People

Promote policy and institutional change that will stimulate agricultural growth and equity to benefit the poor, especially rural women and other disadvantaged groups

Theme 3.a: Policy and institutional innovation

Evaluation of trade, price and public investment policies as they affect pro-poor agriculture and equitable access to environmental services [10] This includes:	
Enhance capacity for trade-off modeling and the ability to forecast trends and issues affecting equitable outcomes <i>[Comment: Requires development (at the CGIAR level) linking CGIAR current capacities with external partners for modeling and forecast capacity – see also 5A.]</i>	
Emphasis on science and technology policies (genetic resources access, certification, efficacy of natural resources management policy, payment for services, benefit sharing) <i>[Comment: Requires research planning at the CGIAR level]</i>	
Improvement in the efficiency and equity of input markets, including seeds, fertilizer, pesticides, and labor. <i>[Comment: Requires research planning at the CGIAR level]</i>	
Enhancing rural institutions and governance for equitable agricultural production and sustained environmental services [11] This includes:	
Innovation in public-private partnerships for governance and the improved efficiency of rural institutions critical to agriculture and natural resources management in developing countries.	<i>5C - Specific goal 2: Identify new forms of partnership with NARS, the private sector, public extension agencies, NGOs and producers' organizations, and public agencies from other sectors, such as environment and health to enhance the conduct and impact from agricultural research.</i>
Property rights affecting the poor, especially women, in terms of access to land, finance, water and other natural resources.	<i>4A, Specific goal 5: in relation to identification of features which enhance individual and collective property rights, and 5D – identify options for the rural poor to access, acquire, protect and use assets.</i>
Comparative research on other governance issues, including decision-making structures and factors that contribute to regulatory enforcement.	<i>4A, Specific goal 5: Create multiple benefits and improved governance of environmental resources through the harmonization of inter-sectoral policies and institutions</i>

<p>Policy and institutional innovations to connect smallholders to markets and facilitate diversification</p> <p>This includes:</p>	
<p>Identification of high value products and opportunities for product markets accessible to small holders</p>	<p><i>Aspects of 3A (high value fruit and vegetables), 2D (improved tree products and other high value species) and 5B (markets) which require to be reformulated in a research approach</i></p>
<p>Research on producer organizations</p>	<p><i>5C - Specific goal 1: Identify mechanisms for the strengthening of producers' organizations and for modes of participatory research.</i></p>
<p>Identification of quality, food safety and other policy and institutional constraints</p>	<p><i>5B - Specific goal 1: Enhance livelihoods and competitiveness for smallholder producers and food safety for consumers influenced by changes in national and international markets.</i></p>
<p>Development of equitable policy options to encourage small-holder participation</p>	<p><i>5B - Specific goal 2: Improve the marketing environment for smallholders by improving the efficiency of domestic markets.</i></p>

Theme 3.b: Gender Equity

<p>Institutional innovation to build assets and empowerment, with a special focus on women in agriculture</p> <p>This includes:</p>	
<p>Enhanced studies on gender responsive policies and institutional improvement at different cultural and traditional socioeconomic environments, to promote women's access to the benefits of agricultural technological innovation <i>[Comment: Research approach remains to be formulated at CGIAR level]</i></p>	
<p>Evaluation of gender-responsive policies for equitable access to and benefits from natural resources <i>[Comment: Research approach remains to be formulated at CGIAR level]</i></p> <p>This includes:</p>	
<p>Incorporating poverty and gender issues into policy and water management solutions <i>[Comment: This is given as a specific example but the research approach remains to be formulated in different areas of agriculture at CGIAR level]</i></p>	