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Congruence of the Hatch Funded Regional Research Portfolio with National and Regional Research Priorities

by

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W. Burt Sundquist and Dan Halbach*

Executive Summary

The major focus of this report is on evaluation of the extent to which the allocation of regional research funding support, particularly the allocation of Hatch Regional Research Funds (RRF), is congruent with national and regional research priorities. Other objectives are to evaluate the appropriate duration of regional research projects and to recommend a process for the selection and development of National Research Projects (NRPs) and National Research Support Projects (NRSPs).

Our evaluation of research funding was conducted at 5-year intervals from 1975 to 1990. In 1975 RRF support totalled slightly less than \$16 million annually. This increased to over \$35 million in 1990, an increase of 120.2 percent. And all of that growth had occurred by 1985. In real (1982) dollar terms, however, peak funding occurred in 1980 and declined 19.3 percent by 1990. Total nominal dollar funding for regional research increased over the entire 1975 to 1990 period reaching \$220 million in the latter year for a 218.5 percent increase. Real dollar funding peaked in 1985, however, and then declined by about 13.7 percent by 1990. Total scientist years (SYS) followed a similar pattern as for total funding with a peak of 1,153 in 1985 and a 13.7 percent decline by 1990.

Among the national research goals receiving increased priority for new research funding over the study period were improved water quality, enhanced sustainability of

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natural resources, increased biological diversity, development of new biotechnologies, improved human nutrition and food safety, enhanced competitiveness in export markets and improved marketing, processing and distribution systems. Among the research areas given lower priority for new funding were animal and crop production systems, community and rural development, and family and consumer research, the latter excluding work on nutrition and food safety.

At the national level, changes in RRF and total funding for regional research were evaluated for 11 research goal categories. These include 1) foreign market expansion, 2) food safety, 3) natural resources & environment, 4) enhanced biological technology, 5) human nutrition & consumer choice, 6) marketing efficiency & trade competition, 7) development of human capital, 8) productivity enhancement for crops, 9) productivity enhancement for livestock, 10) rural & community development, and 11) new & improved products.

In 1990, as in 1975, three research goals, 1) enhanced biological technology, 2) productivity enhancement for crops and, 3) productivity enhancement for livestock, captured a high proportion (63.7% in 1975 and 74.7% in 1990) of total RRF support. Within this mix, however, support for plant related biological research gained relative to livestock. Foreign market expansion research had the greatest percentage gain in RRF support (482.3% in 1982 dollars), but started from the extremely small base of only \$18 thousand in 1975. Rural and community development research, on the other hand, took the largest cut in RRF support, losing 73.8 percent in real (1982) dollars. RRF support for at least three research goals, 1) natural resources & environment, 2) market efficiency & trade competition and 3) food safety, appear not to have gained the increased funding support justified by their national priority rankings.

Again at the national level, changes from 1975 to 1990 in RRF and total funding support were computed for the 24 so-called "commodity" categories with the largest RRF support base in 1975. All 4 major livestock commodity categories (beef, dairy, poultry and swine) ranked within the top 10, while most major crop commodities were ranked somewhat lower. Thus a high degree of congruence exists between the value of commodities produced for commercial markets and the level of their RRF support base. Soybeans, with an increase in real funding of 240 percent, realized the largest percentage gain between

1975 and 1990. Soybeans were followed in order of percentage rate of funding gain by ornamentals & turf, vegetables, food, small fruits & nuts, and wheat, respectively. Thus no "natural resource" related commodities shared in high rates-of-gain in RRF support. Water, air & climate and marketing systems & sectors are among the several categories for which changes in funding support appear to have been short of the priority rankings generally afforded these commodity groups. But the water - air and climate topics do also receive research support from nonagricultural funding sources.

Changes in RRF support at the national level between 1975 and 1990 were also computed for the 10 commodity categories with the lowest 1975 funding base. Here a number of commodities including 1) rice, 2) research on research management, 3) weeds, 4) the farm as a business, 5) biological cell systems, and 6) microorganisms & viruses, all showed real (1982) dollar gains of more than 200 percent. Generally speaking, these changes appear consistent with current national priorities though none appear among the most commonly articulated priorities.

RRF support for commodity categories in the four SAES regions varies significantly by region. Generally support of commodity categories is highly congruent with the economic importance (market value) of commodities in each region. Differences in commodity funding levels among regions and changes from 1975 to 1990 track well with the high degree of commercial agriculture in the North Central and Southern regions. Support of non-market commodities in the North East, e.g., water, soil and land, trees, etc., is generally congruent with the more diverse research priorities for this region although increased funding for communities, areas and regions barely kept pace with inflation. In the Western region, funding for 1) soil & land and 2) water research, appears not to have kept pace with the high priority afforded these commodity groups. None-the-less, these categories both ranked in the top 6 in 1990 reflecting an earlier (pre-1975) recognition of their importance for funding support.

In all four regions, consideration might be given to closing out RRF support for commodity groups with lower priority and lower funding levels. If so, some of the current priority areas, e.g., biotechnology, environmental quality & resource sustainability, and trade competitiveness could be allocated additional funding support if strong project proposals were developed.

There is a general consensus that with increased funding of applied and developmental research by the private sector, and with a decline in real public research funding, an increased proportion of public funding should be directed to basic research. In 1975, 61.9 percent of RRF support went for applied, 32.9 percent for basic and 5.2 percent for developmental research. In 1990, these proportions had changed to 54.3 percent applied, 40.0 basic and 5.6 percent developmental research. Thus, the shift to support of an increased proportion of basic research appears congruent with articulated priorities. Moreover, the percentage of basic research support is highest for those research goal categories (such as human health & nutrition, plant & animal protection, and new and improved products) for which basic research is of crucial importance.

The question of the optimal duration for RRF supported research projects is a complex issue. Research projects tend to fall into one of two categories: 1) those addressing more generic problems of a continuing nature, and 2) those with objectives of more limited scope and with more readily defined research procedures and time requirements. For those projects with a continuing agenda, continued questioning needs to occur vis-a-vis the priority of the projects and their suitability for the regional research format. Such projects should probably be approved for a period of 4 to 5 years with project renewal regularly requiring peer evaluation of the project's quality and productivity. Those projects addressing research which is more specific in terms of individual technologies, functions, commodities, markets, etc., are more readily bounded in terms of the content of research program and the time requirements for completion. For such projects, a duration time of 3 to 4 years with maximum extension of 1 to 2 years is probably appropriate. In many cases, research can be completed within a 3 year period but there are additional time requirements for manuscript development and review and for publication.

Finally, with respect to a process of selection and development of NRPs and NRSPs, a sequential process is briefly developed and discussed. This includes a very open process for identification and nomination of project proposals. After narrowing the list to projects of high priority on a judgement basis,

a modest "technology assessment" type of procedure is suggested for ranking projects for potential approval. Such a procedure can help to assess the potential technical, economic, environmental, and social impacts of proposed projects as well as their timeliness, likelihood of success, and organizational and resource feasibilities. Although such a process would still retain a good deal of subjectivity, it appears the only alternative to approving projects solely on a judgement basis.

Introduction

The extent of congruence of regional funding for agricultural research with articulated research priorities could be readily measured if 1) research priorities were clearly identified and unambiguously ranked, 2) these rankings were quantitatively weighted and 3) available data base categories for research expenditures could be matched with research priority categories on a one-to-one basis. Since none of these three requirements can be readily met, some improvisation is required in the process of evaluating congruence.

The problem of identifying research priorities has several dimensions. First, there is no single source for identifying research priorities although the periodic reports of the Joint Council on Food and Agricultural Sciences (JCFAS) serve as a good starting point if one assumes that these reports represent a reasonable representation of national and regional research priorities. Second, many articulations of research priorities are for "new money" and are based on the assumption of some specified funding availability which typically is not the level actually realized. Third, such priority categories as Soil, Water and Air (a high priority in the JCFAS's 1986 projections for 1990) are rather broad research categories which are not generally mutually exclusive of other research categories.

With respect to the CRIS data base for measuring realized research expenditures, two general problems are paramount. First, the research problem area categories (RPAs) in that data base were determined in the late 1960s, and do not match well with some of the research categories from which current research priorities are specified. Some selective changes in commodity categories would also be desirable to reflect changes which have occurred over time. As an example, it would be useful to provide more specific focus on such research categories as biotechnology, natural resource sustainability, etc. Second, as with most data systems which are dependent on a large number of reporting institutions and individuals, there are problems of inconsistent data, e.g., differing classifications of research projects

and/or expenses, incomplete reporting, etc. In the short-term, at least, these "data quality" problems can be recognized to exist but can not be resolved.

The above problems notwithstanding, in the next several sections of this report we undertake to evaluate, as best we can, the congruence in use of the Hatch RRF Allocations (as well as the total funds allocated to regional research) with articulated national and regional priorities for agricultural research. An effort is also made to provide some insights in terms of funding allocation vis-a-vis 1) basic, applied and developmental research, 2) selected commodity groups, and 3) the four geographical regions. Of necessity, heavy reliance must be placed on the CRIS data since there simply is no other comprehensive data source.

Research Priorities

At the time of the formulation of the Current Research Information System (CRIS) in the 1960s, nine primary research goals (RPGs) were identified for the public Federal-State Agricultural Research System. These include the following:

Goal I: Insure a Stable and Productive Agriculture for the Future Through Wise
Management of Natural Resources

Goal II: Protect Forests, Crops and Livestock from Insects, Diseases and Other
Hazards

Goal III: Produce an Adequate Supply of Farm and Forest Products at
Decreasing Real Production Costs

Goal IV: Expand the Demand for Farm and Forest Products by Developing New
and Improved Products and Processes and Enhancing Product Quality

Goal V: Improve Efficiency in the Marketing System

Goal VI: Expand Export Markets and Assist Developing Nations

Goal VII: Protect Consumer Health and Improve Nutrition and Well-Being of the
American People

Goal VIII: Assist Rural Americans to Improve Their Level of Living

Goal IX: Promote Community Improvement Including Development of Beauty,
Recreation, Environment, Economic Opportunity, and Public Service

Achievement of these 9 research goals was to be accomplished by pursuit of work on a set of 98 research problem areas (RPAs) within 8 research program groups (RPGs) and 63 research programs (RPs) associated with 58 categories of commodities. A listing of the RPAs, RPGs, RPs and commodity categories is provided in Appendices A,B and C.

At the outset of its development, no formal priority weights were attached to the definitional categories built into the CRIS system. Yet over time these initial categories, with some modifications, amplifications and reformulations (e.g., the so-called "Joint Council Program Categories") have served as the informal operating basis from which statements about research priorities are formulated.

Among the research goals receiving increased priority in recent years¹ are such diverse topics as improved quality of ground water and sustainability of natural resources (often categorized as water, soil and air), increased biological diversity, development of new agricultural biotechnologies, improved human nutrition and food safety, enhanced competitiveness in export markets and improved marketing, processing and distribution systems. Among the topics given lower priority, particularly in the articulation of new research initiatives, are those of animal and crop production systems, community and rural development, and family and non nutrition-food safety related consumer research.

In an effort to better match research priorities with the allocation of regional research funding, we have undertaken some selective reformulation of the nine CRIS research goal categories. This reformulation will be discussed later in the report.

Size of the Regional Research Program

The magnitude of the SAES-CSRS Regional Research Program, including interregional (IR) projects, is reported in Tables 1(a) and 1(b) at 5 year intervals (1975 to 1990) using 1975 as a base year. Although regional research was being conducted prior to 1975, our evaluation of available data indicates that the quality of numbers reported to CRIS in individual RPA categories had not stabilized much before that date. Substantial increases (120.2 percent) occurred between 1975 and 1990 in the Hatch RR Funds allocated to regional research (Table 1(a)). But, even on this nominal (undeflated) value basis these increases had all occurred by 1985. Moreover, when funds

¹ See, for example, 1986 and 1988 Five-Year Plans for the Food and Agricultural Sciences by the Joint Council and "Research Agenda for the 1990s: A Strategic Plan for the State Agricultural Experiment Stations" Report of the Planning and Budget Subcommittee of ESCOP.

TABLE 1(a)

Hatch RRF Allocations in 1975, 1980, 1985 and 1990
and Percent Changes from 1975 to 1990

	1975	1980	1985	1990	% Change 1975-90
Nominal \$					
NC	4,050,255	7,057,438	9,553,033	9,310,405	129.9
NE	3,383,637	5,283,000	7,189,969	7,137,632	110.9
S	4,645,813	8,018,344	10,513,055	10,398,587	123.8
W	3,905,291	6,181,449	8,362,183	8,356,215	114.0
US	15,984,966	26,540,231	35,618,240	35,202,839	120.2
1982\$*					
NC	6,899,923	8,554,470	7,974,151	5,811,738	-15.8
NE	5,764,288	6,403,636	6,001,644	4,455,451	-22.7
S	7,914,503	9,719,205	8,775,505	6,491,003	-18.0
W	6,652,966	7,492,665	6,980,119	5,216,114	-21.6
US	27,231,680	32,169,977	29,731,419	21,974,306	-19.3

* This and subsequent deflation of funding data was accomplished by updating the State Agricultural Experiment Station Faculty Compensation Index in David N. Bengston, "A Price Index for Deflating State Agricultural Experiment Station Research Expenditures," The Journal of Agricultural Economics Research/Vol. 41, No. 4, Fall, 1989.

TABLE 1(b)

Total Scientist Years (SYS) and Total Funds Allocated to Regional Research
in 1975, 1980, 1985 and 1990 and Percent Changes from 1975 to 1990

	1975	1980	1985	1990	% Change 1975-90
SYS					
NC	190.5	218.1	276.6	241.3	26.7
NE	153.1	183.5	181.0	181.2	18.4
S	255.6	332.7	415.4	320.0	25.2
W	200.2	239.6	280.1	253.2	26.5
US	799.4	973.9	1,153.1	995.7	24.6
Nominal \$					
NC	23,820,893	39,151,145	54,726,851	64,611,502	171.2
NE	11,042,165	18,202,139	27,093,470	38,490,157	248.6
S	19,255,151	38,752,821	65,729,487	64,347,412	234.2
W	14,954,116	26,568,833	40,918,601	52,567,123	251.5
US	69,072,325	122,674,938	188,468,409	220,016,194	218.5
1982\$					
NC	40,580,738	47,455,493	45,681,846	40,331,774	-0.6
NE	18,811,184	22,063,199	22,615,584	24,026,315	27.7
S	32,802,642	46,973,116	54,866,016	40,166,924	22.5
W	25,475,496	32,204,646	34,155,760	32,813,435	28.8
US	117,670,060	148,696,895	157,319,206	137,338,448	16.7

are deflated to constant 1982 dollars, erosion in Hatch RRF becomes apparent even in the early 1980s. Whereas real (deflated) increases in funding of more than 18 percent occurred between 1975 and 1980, by 1990 real funding had eroded substantially and the overall decline in real Hatch RRF from 1975 to 1990 totalled to 19.3 percent.

Total scientist years (SYS) and total financial support (funding from all sources) are shown in Table 1(b). Whereas SYS increased substantially from 1975 to 1985 (44.2%), they declined by 13.7 percent from 1985 to 1990 for a net increase over the total 1975-1990 period of 24.6 percent. As a practical matter, SYS in the NE region peaked in 1980 and declined only very modestly after that time.

In nominal dollars, funding for regional research from all sources showed an even larger percentage increase (218.5 percent) from 1975 to 1990 than for Hatch RRF monies. Whereas total funding in the Southern region increased by the highest percentage of any region from 1975-1985, it showed a slight decline, even in nominal terms, from 1985 to 1990.

In real (1982) dollars total funding for regional research showed an increase of 16.7 percent from 1975 to 1990. After peaking in the mid 1980s, however, total funding declined by 12.7 percent from 1985 to 1990.

In summary, in real dollars the availability of Hatch RRF monies declined significantly after the early 1980s and a decline in total regional research funds occurred in the late 1980s. Except for the North East Region, SYS increased significantly from 1975 to 1985 and declined substantially thereafter. Thus the allocation of research support to alternative research goals during the period of study occurred in an environment of declining real resources for regional research.

Changes in Funding for Regional Research

by CRIS Research Goals

Base 1975 funding for regional research and percentage changes from 1975 to 1990 are shown in nominal and real (1982) dollars (tables 2(a) and 2(b)) for each of the nine CRIS research goals. Not surprisingly, there is great variation in both the funding levels for different goals and in their percentage changes over the 15 year period. But as indicated earlier, inflation took a serious toll on monies available for research since a research dollar in 1990 was worth less than 37 cents of its 1975 counterpart.

Although the greatest percentage increase in nominal dollars funding was for foreign trade and development research (table 2 (a)), funding support for this goal started from an extremely low level in 1975. Funding did increase substantially, however, as the volume of trade in U.S. farm commodities declined from its high volume of the 1970s and high priority was given to the goal of helping to restore trade volume to its earlier levels.

At the other extreme, the volume of funding for rural development research surged after passage of the Rural Development Act of 1972, but declined dramatically during the 1980s as rural development funding was reduced and lost its visibility as earmarked money. Even in nominal dollars, rural development funding declined substantially between 1975 and 1990 both for Hatch RRF and for total funding for regional research.

Among other differences of note in table 2(a) are that (1) although Hatch RRF support for marketing efficiency and consumer health and nutrition research increased at only a very modest rate between 1975 and 1990, total funding in support for these goals increased by more than 200 percent and (2) both RRF and total funding support for natural resource management increased at a higher percentage rate than for all but foreign trade and development.

TABLE 2(a)

Changes in Nominal Dollar Funding for Regional Research by CRIS Research Goals, 1975-90

CRIS Research Goals	Geographic Region	Hatch RRF 1975 Base \$	Hatch RRF 1990	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90	Hatch RRF Leverage, 1975	Hatch RRF Leverage, 1990
1. Natural Resource Management	U.S.	1,056,091	4,361,147	313.0	3,560,620	26,461,360	643.2	3.37	6.07
2. Plant & Animal Protection	U.S.	2,754,488	7,600,013	175.9	8,412,057	42,207,198	401.7	3.05	5.55
3. Production Cost Reduction	U.S.	4,637,020	12,415,612	167.7	22,254,020	83,934,936	277.2	4.80	6.76
4. New & Improved Products	U.S.	1,171,539	2,467,116	110.6	3,531,331	14,979,699	324.2	3.01	6.07
5. Marketing Efficiency	U.S.	1,468,760	1,950,019	32.8	3,278,343	10,335,227	215.3	2.23	5.30
6. Foreign Trade & Development	U.S.	20,291	290,554	1,331.9	31,064	2,508,757	7,976.1	1.53	8.63
7. Consumer Health & Nutrition	U.S.	1,408,049	2,373,067	68.5	4,438,737	15,083,124	239.8	3.15	6.36
8. Improved Family Living	U.S.	634,955	1,306,657	105.8	1,332,997	7,108,786	433.3	2.10	5.44
9. Rural Development	U.S.	2,833,803	2,438,654	-13.9	22,233,156	17,397,107	-21.8	7.85	7.13
All	U.S.	15,984,966	35,202,839	120.2	69,072,325	220,016,194	218.5	4.32	6.25
All	NC	4,050,255	9,310,405	129.9	23,820,893	64,611,502	171.2	5.88	6.94
All	NE	3,383,637	7,137,632	110.9	11,042,165	38,490,157	248.6	3.26	5.39
All	S	4,645,813	10,398,587	123.8	19,255,151	64,347,412	234.2	4.14	6.19
All	W	3,905,291	8,356,215	114.0	14,954,116	52,567,123	251.5	3.83	6.29

Between 1975 and 1990, the leverage ratio for total funding for regional research relative to Hatch RRF monies increased substantially for all but the rural development category. Thus to the extent that Hatch RRF funds are seen as "seed or leverage money" for attracting additional funding support, performance on that measure improved over the period 1975 to 1990. Although there are some modest differences in leverage ratios among research categories, these are difficult to explain except for the major surge in the leverage ratio for foreign trade and development. Clearly, this research goal became one of increased priority for funding from virtually all sources of research support.

Finally, with respect to Table 2(a), the leverage ratio for Hatch RRF monies is somewhat less for the NE than for the three other regions. This probably reflects mainly the increased difficulty in securing non-federal money for agricultural research in some states within the NE Region. Thus conduct of regional research in the NE region appears particularly dependent on Hatch RRF for support.

Table 2(b) shows the allocation of funds in constant (1982) dollars for the same 9 CRIS research goal categories as table 2(a). In terms of Hatch RRF allocations, only two categories, Natural Resource Management and International Trade and Development showed major percentage increases (of 51.3 and 424.7 percent, respectively, between 1975 and 1990. Real dollar funding for Rural Development and Marketing Efficiency goals declined by 68.5 and 51.4 percent respectively. The percent funding changes by 5-year intervals show that, for most research goals, the level of real funding declined after 1980.

Except for rural development which took a dramatic cut, total real dollar funding for other regional research goals increased from 1975 to 1990 (last column Table 2(b)). This masks the fact, however, that total real dollar funding for only two categories, natural resource management and agricultural trade and development increased significantly from

TABLE 2(b)

Changes in Real Funding for Regional Research by CRIS

9 Research Goals, 1975-90 (1982 \$)

CRIS Research Goals	Geographic Region	Hatch RRF 1975 Base \$	Hatch RRF 1990	% Change 1975-80	% Change 1975-85	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90
1. Natural Resource Management	U.S.	1,799,133	2,722,314	27.5	76.9	51.3	6,065,792	16,517,703	172.3
2. Plant & Animal Protection	U.S.	4,692,484	4,744,078	33.3	30.0	1.1	14,330,591	26,346,566	83.8
3. Production Cost Reduction	U.S.	7,899,523	7,750,070	37.9	29.1	-1.9	37,911,448	52,393,483	38.2
4. New & Improved Products	U.S.	1,995,807	1,540,022	27.3	12.4	-22.8	6,015,896	9,350,624	55.4
5. Marketing Efficiency	U.S.	2,502,147	1,217,240	0.9	-19.3	-51.4	5,584,911	6,451,453	15.5
6. Foreign Trade & Development	U.S.	34,567	181,370	323.2	235.8	424.7	52,920	1,566,016	2,859.2
7. Consumer Health & Nutrition	U.S.	2,398,721	1,481,315	11.5	-7.9	-38.2	7,561,733	9,415,184	24.5
8. Improved Family Living	U.S.	1,081,695	815,641	26.6	17.9	-24.6	2,270,864	4,437,444	95.4
9. Rural Development	U.S.	4,827,603	1,522,256	-28.0	-50.5	-68.5	37,875,905	10,859,617	-71.3
All	U.S.	27,231,680	21,974,306	18.1	9.2	-19.3	117,670,060	137,338,448	16.7
All	NC	6,899,923	5,811,738	24.0	15.6	-15.8	40,580,738	40,331,774	-0.6
All	NE	5,764,288	4,455,451	11.1	4.1	-22.7	18,811,184	24,026,315	27.7
All	S	7,914,503	6,491,003	22.8	10.9	-18.0	32,802,642	40,166,924	22.5
All	W	6,652,966	5,216,114	12.6	4.9	-21.6	25,475,496	32,813,435	28.8

1985 to 1990. During this period, funding for all other research goals, except plant and animal protection, failed seriously to keep up with the costs of inflation.

A Reformulation of Research Goal Categories

The 9 CRIS research goals in (tables 2(a) and 2(b)) were reformulated on a judgement basis into 11 categories in an effort to more nearly approximate the categories for which research priorities are often currently articulated. This reformulation was accomplished by reaggregating individual existing RPAs for each of the new research goal categories. Because the 11 categories are not defined to be entirely mutually exclusive, aggregate expenditures differ slightly from the aggregates for the 9 CRIS categories. Results from this reformulation of research goals are presented in tables 3(a) and 3(b).

Among the objectives of the reformulation of research goals were the following: 1) a separation of consumer health and nutrition research from that for food safety, 2) a selective redefinition of natural resources research to include identifiable environmental work as well, 3) a separating of productivity related research for crops from that for livestock, 4) creation of a new research goal for "enhanced biological technology", 5) a narrower focusing on a marketing efficiency and trade competition goal separate from foreign market expansion, and 6) narrower and more targeted focuses on human capital development, new and improved products and rural and community development. RPAs included in each of the reformulated research goals are listed in Appendix D.

Changes in Nominal Funding, 1975-90

Funding for three categories of research goals, those for enhanced biological technology and productivity enhancement for plants and animals, respectively, dwarf

TABLE 3(a)

Changes in Regional Research Funding for Reformulated Research Goals, 1975-90 (nominal \$)

Research Goals	Geographic Region	Hatch RRF 1975 Base \$	Hatch RRF 1990 \$	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90
1. Foreign Market Expansion	U.S.	18,234	289,763	1,489.1	20,950	2,491,592	11,793.0
2. Food Safety	U.S.	628,345	1,143,439	82.0	2,105,630	5,848,956	177.8
3. Natural Resources & Environment	U.S.	1,827,771	2,618,603	43.3	6,428,796	19,741,054	207.1
4. Enhanced Biological Technology	U.S.	2,948,620	7,937,334	169.2	14,050,410	54,664,460	289.1
5. Human Nutrition & Consumer Choice	U.S.	584,239	764,974	30.9	1,756,250	5,514,614	214.0
6. Marketing Efficiency & Trade Competition	U.S.	730,709	982,900	34.5	1,487,849	6,208,561	317.3
7. Human Capital Development	U.S.	368,757	848,747	130.2	831,737	3,669,068	341.1
8. Productivity Enhancement, Plants	U.S.	3,660,083	10,774,212	194.4	11,500,664	56,724,656	393.2
9. Productivity Enhancement, Livestock	U.S.	3,869,941	8,884,145	129.6	19,900,983	66,595,237	234.6
10. Rural & Community Development	U.S.	1,063,391	760,844	-28.5	2,455,942	4,652,663	89.4
11. New & Improved Products	U.S.	744,427	1,667,899	124.1	2,153,895	9,455,518	339.0

expenditures for other research goals both in 1975 and in 1990 (table 3(a)). All three categories show significant increases in RRF and major increases in total funding support between 1975 and 1990 in nominal dollars. Although it is difficult to separate "general biological technology" from "productivity enhancement for crops and livestock", the relative changes in RRF support shown in table 3(a) appear consistent in direction with the currently higher priority generally being assigned to plant biological research. Research on Foreign Market Expansion shows by far the largest increase in both Hatch RRF and total RR expenditures. But the funding level is very modest compared to all other goal categories. Although the category is modified some from its CRIS research goal definition, rural and community development research continues to show a major decline in RRF support even in nominal dollars.

Changes in Real Funding, 1975-90

Changes in real funding support for the 11 reformulated research goals are shown in table 3(b). In terms of RRF support, only one research goal category, foreign market expansion, shows a major increase in real funding. And only one other research goal, plant productivity enhancement, shows a positive change (8 percent). In viewing the percentage changes in real funding at 5-year intervals, it is again apparent that significant funding increases occurred in 7 of the 11 categories from 1975 to 1980 after which declines occurred in all but the foreign market expansion category.

Although the 11 reformulated research goals (tables 3(a) and 3(b)) appear to be more closely aligned to currently articulated research groupings than the 9 CRIS goals, they still remain excessively aggregative for congruency testing objectives. But attempts at more disaggregative formulations of research goals encountered substantial definitional

TABLE 3(b)

Changes in Real Funding for Regional Research for
11 Reformulated Research Goals, 1975-90 (1982 \$)

Research Goals	Geographic Region	Hatch RRF 1975 Base \$	Hatch RRF 1990 \$	% Change 1975-80	% Change 1975-85	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90
1. Foreign Market Expansion	U.S.	31,063	180,876	352.5	261.3	482.3	35,690	1,555,301	4,257.8
2. Food Safety	U.S.	1,070,434	713,757	20.2	6.2	-33.3	3,587,104	3,651,034	1.8
3. Natural Resources & Environment	U.S.	3,113,750	1,634,584	-42.7	-43.8	-47.5	10,951,952	12,322,755	12.5
4. Enhanced Biological Technology	U.S.	5,023,203	4,954,640	42.8	33.5	-1.4	23,935,963	34,122,634	42.6
5. Human Nutrition & Consumer Choice	U.S.	995,296	477,512	2.8	-26.6	-52.0	2,991,908	3,442,231	15.1
6. Mkt Efficiency & Trade Competition	U.S.	1,244,819	613,546	-2.3	-41.1	-50.7	2,534,666	3,875,506	52.9
7. Human Resource Development	U.S.	628,206	529,805	53.8	21.0	-15.7	1,416,928	2,290,305	61.6
8. Productivity Enhancement, Plants	U.S.	6,235,235	6,725,476	39.9	39.1	7.9	19,592,273	35,408,649	80.7
9. Productivity Enhancement, Livestock	U.S.	6,592,744	5,545,659	31.8	15.2	-15.9	33,902,867	41,570,061	22.6
10. Rural & Community Development	U.S.	1,811,569	474,934	-47.4	-48.2	-73.8	4,183,888	2,904,284	-30.6
11. New & Improved Products	U.S.	1,268,189	1,041,135	40.2	21.1	-17.9	3,789,055	5,902,321	60.9

problems. In a very real sense these problems can only be addressed through a redefinition of RPAs which better fits a contemporary set of research goals (priorities).

One cannot go back and effectively redefine the historical RPAs. But one can further disaggregate RPAs in future reporting in order to better match the new categories for research priorities.

Changes in Funding for Regional Research by

Selected Commodity Groups, 1975-1990

Tables 4(a) and 4(b) depict the changes in nominal and real funding support for regional research from 1975 to 1990 for the 24 "commodity" groups* which had the largest RRF support base in 1975. Tables 5(a) and 5(b) present the same information for the 12 commodity groups with the smallest initial (1975) RRF support.

Rather clearly in evaluating the funding priority given different commodity groups, it is important to consider both the level of the initial funding base and the changes occurring over time. Moreover, there is no simple way to weight these two considerations into a single evaluative measure. Most articulations of research priorities do not single out individual commodities but focus on research goals at a more functional level. To the extent that articulations of research priorities have focused on commodities in recent years, they have usually given higher priority to a commodity research category on the basis of:

- 1) market revenue generated,

* In addition to commodities, these groups include such research categories as natural and human resources, technologies and other research areas. See Appendix B for a list of specific "commodity" categories.

TABLE 4(a)

Nominal Changes in Regional Research Funding for Selected Commodities, 1975-90

(Ranked from Highest Hatch RRF 1975 Funding Base)

Commodity	Code	Geographic Region	Hatch RRF 1975 Base \$	Hatch RRF 1990	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90	Hatch RRF Leverage, 1990
Beef Cattle	3000	U.S.	2,159,018	2,585,474	19.8	9,685,474	18,584,169	91.9	7.19
Soil & Land	0100	U.S.	1,093,278	2,054,608	87.8	3,649,928	14,460,996	296.2	7.04
Dairy Cattle	3100	U.S.	1,029,911	2,802,072	172.1	5,454,038	20,819,299	281.7	7.43
Poultry	2900	U.S.	852,661	2,260,518	165.1	3,003,373	14,041,019	367.5	6.21
Forages	2000	U.S.	821,183	1,780,400	116.8	2,190,351	7,405,601	238.1	4.16
Water	0200	U.S.	806,573	1,321,671	63.9	2,979,601	9,373,811	214.6	7.09
Community Development	4300	U.S.	720,598	683,024	-5.2	1,657,317	3,792,825	128.9	5.55
Small Fruits & Nuts	1000	U.S.	667,299	2,374,931	255.9	1,962,456	11,656,750	494.0	4.90
People: Workers & Consumers	4000	U.S.	612,831	544,114	-11.2	1,625,967	3,421,467	110.4	6.29
Swine	3200	U.S.	580,638	1,708,489	194.2	2,965,760	13,326,338	349.3	7.80
Vegetables	1200	U.S.	550,576	2,148,295	290.2	1,782,720	11,072,408	521.1	5.15
Food	3800	U.S.	468,675	1,247,300	166.1	1,424,888	8,765,781	515.2	7.03
Plants	6700	U.S.	452,504	1,181,895	161.2	1,531,878	6,512,988	325.2	5.51
Corn	1400	U.S.	451,867	1,016,633	125.0	1,301,045	5,227,617	301.8	5.14
Cotton	2100	U.S.	439,802	640,777	45.7	1,372,328	3,629,005	164.4	5.66
Trees, Forests & Forest Products	0600	U.S.	367,362	822,593	123.9	1,611,776	4,465,025	177.0	5.43
Sheep & Wool	3300	U.S.	363,236	717,636	97.6	1,492,093	5,942,098	298.2	8.28
Marketing Systems & Sectors	4800	U.S.	299,927	97,029	-67.6	755,203	827,450	9.6	8.53
Soybeans	2300	U.S.	246,719	1,149,925	366.1	813,568	7,545,773	827.5	6.56
Wheat	1700	U.S.	241,041	468,455	94.3	622,839	3,503,594	462.5	7.48
Ornamentals & Turf	1300	U.S.	221,995	619,562	179.1	502,433	3,769,050	650.2	6.08
Air & Climate	0400	U.S.	176,160	244,628	38.9	565,636	2,262,093	299.9	9.25
Family & Family Members	4100	U.S.	159,357	474,445	197.7	352,859	1,770,503	401.8	3.73
Recreation Resources	0500	U.S.	146,658	139,986	-4.5	383,746	1,034,496	169.6	7.39

TABLE 4(b)

Real (1982-Dollar) Changes in Regional Research Funding for Selected Commodities, 1975-90

(Ranked from Highest Hatch RRF 1975 Funding Base)

Commodity	Code	Geographic Region	Hatch RRF 1975 Base \$	% Change 1975-80	% Change 1975-85	Hatch RRF 1990 \$	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90
Beef Cattle	3000	U.S.	3,678,055	7.1	-3.2	1,613,904	-56.1	16,499,956	11,600,605	-29.7
Soil & Land	0100	U.S.	1,863,336	-14.8	-14.1	1,282,527	-31.2	6,217,935	9,026,839	45.2
Dairy Cattle	3100	U.S.	1,754,533	55.3	30.0	1,749,109	-0.3	9,291,376	12,995,817	39.9
Poultry	2900	U.S.	1,452,574	44.8	-6.3	1,411,060	-2.9	5,116,479	8,764,681	71.3
Forages	2000	U.S.	1,398,949	16.9	14.5	1,111,361	-20.6	3,731,433	4,622,722	23.9
Water	0200	U.S.	1,374,060	-50.6	-51.2	825,013	-40.0	5,075,981	5,851,318	15.3
Community Development	4300	U.S.	1,227,595	-44.1	-32.7	426,357	-65.3	2,823,368	2,367,556	-16.1
Small Fruits & Nuts	1000	U.S.	1,136,796	44.8	42.6	1,482,479	30.4	3,343,196	7,276,373	117.6
People: Workers & Consumers	4000	U.S.	1,044,005	-11.4	-38.2	339,647	-67.5	2,769,961	2,135,747	-22.9
Swine	3200	U.S.	989,162	13.7	8.7	1,066,473	7.8	5,052,402	8,318,563	64.6
Vegetables	1200	U.S.	937,949	78.6	79.9	1,341,008	43.0	3,037,002	6,911,615	127.6
Food	3800	U.S.	798,424	66.7	18.5	778,589	-2.5	2,427,407	5,471,773	125.4
Plants	6700	U.S.	770,876	26.0	22.7	737,762	-4.3	2,609,673	4,065,536	55.8
Corn	1400	U.S.	769,790	43.1	31.6	634,602	-17.6	2,216,431	3,263,182	47.2
Cotton	2100	U.S.	749,237	5.4	-18.8	399,986	-46.6	2,337,867	2,265,297	-3.1
Trees, Forests & Forests Products	0600	U.S.	625,830	34.9	9.2	513,479	-18.0	2,745,785	2,787,157	1.5
Sheep & Wool	3300	U.S.	618,801	-16.1	-21.4	447,963	-27.6	2,541,896	3,709,175	45.9
Marketing Systems & Sectors	4800	U.S.	510,949	-46.2	-32.8	60,567	-88.1	1,286,547	516,511	-59.9
Soybeans	2300	U.S.	420,305	213.0	147.4	717,806	70.8	1,385,976	4,710,220	239.8
Wheat	1700	U.S.	410,632	23.5	27	292,419	-28.8	1,061,055	2,187,012	106.1
Ornamentals & Turf	1300	U.S.	378,186	25.7	-12.6	386,743	2.3	855,934	2,352,715	174.9
Air & Climate	0400	U.S.	300,102	18.0	14.9	152,702	-49.1	963,605	1,412,043	46.5
Family & Family Members	4100	U.S.	271,477	83.1	50.5	296,158	9.1	601,123	1,105,183	83.9
Recreation Resources	0500	U.S.	249,843	-12.9	-61.3	87,382	-65.0	653,741	645,753	-1.2

TABLE 5(a)

Nominal Changes in Regional Research Funding for Selected Commodities, 1975-1990)

(Ranked from Lowest Hatch RRF 1975 Funding Base)

Commodity	Code	Geographic Region	Hatch RRF 1975 Base \$	Hatch RRF 1990 \$	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90	Hatch RRF Leverage, 1990
Rice	1600	U.S.	2,101	81,846	3,795.6	39,866	967,114	2,325.9	11.82
Foreign Agricultural Economics	4500	U.S.	4,754	16,317	243.2	5,332	212,550	3,886.3	13.02
Biological Cell Systems	6300	U.S.	6,801	66,043	871.1	101,690	517,328	408.7	76.07
Weeds	6100	U.S.	10,419	193,033	1,752.7	27,288	1,242,040	1,080.0	6.43
Research on Research Management	6900	U.S.	10,584	351,133	3,217.6	14,584	745,546	3,000.0	2.12
Bees & Honey	3500	U.S.	11,065	16,073	45.3	93,683	821,721	777.1	51.12
Seed Research	6200	U.S.	15,922	91,185	472.7	72,975	711,704	875.3	7.81
Other Oilseeds	2500	U.S.	18,827	119,300	533.7	46,917	1,873,343	3,892.9	15.70
Tobacco	2600	U.S.	19,945	48,401	142.7	42,658	318,391	646.4	6.58
Farm As Business	4200	U.S.	26,149	392,126	1,399.6	116,610	2,928,556	2,411.4	111.99
Range	700	U.S.	32,392	169,067	421.9	74,918	886,679	1,083.5	27.37
Microorganisms & Viruses	6600	U.S.	34,742	306,814	783.1	56,558	1,525,425	2,597.1	4.97

TABLE 5(b)

Real (1982 Dollar) Changes in Regional Research Funding

for Selected Commodities, 1975-90

(Ranked from Lowest Hatch RRF 1975 Funding Base)

Commodity	Code	Geographic Region	Hatch RRF 1975 Base \$	% Change 1975-80	% Change 1975-85	Hatch RRF 1990 \$	% Change 1975-90	Total RR Expenditures 1975 Base \$	Total RR Expenditures 1990	% Change 1975-90
Rice	1600	U.S.	3,579	1,080.3	1,689.8	51,090	1,327.4	67,915	603,692	788.9
Foreign Agricultural Economics	4500	U.S.	8,099	9.2	-28.5	10,185	25.8	9,083	132,678	1,360.7
Biological Cell Systems	6300	U.S.	11,586	477.3	628	41,225	255.8	173,237	322,926	86.4
Weeds	6100	U.S.	17,750	1.2	848.6	120,495	578.9	46,487	775,306	1,567.8
Research on Research Management	6900	U.S.	18,031	195.3	1,627.9	219,184	1,115.6	24,845	588,313	1,773.2
Bees & Honey	3500	U.S.	18,850	-34.5	-100	10,033	-46.8	159,596	512,934	221.4
Seed Research	6200	U.S.	27,124	-26.2	66.2	56,919	109.8	124,319	444,260	257.4
Other Oilseeds	2500	U.S.	32,073	61.9	275.6	74,469	132.2	79,927	1,169,378	1,363.1
Tobacco	2600	U.S.	33,978	-18.9	44.5	30,213	-11.1	72,671	198,746	173.5
Farm As Business	4200	U.S.	44,547	438.8	630.8	244,773	449.5	198,654	1,828,062	820.2
Range	700	U.S.	55,182	149.0	129.3	105,535	91.2	127,629	553,483	337.7
Microorganisms & Viruses	6600	U.S.	59,186	91.1	172.0	191,519	223.6	96,351	952,200	888.3

- 2) contribution to improved environmental quality and/or resource sustainability,
- 3) contribution to basic scientific knowledge, and
- 4) new or increased market penetration, particularly in international (trade) markets.

Perhaps the most insightful perspective which can be gained from viewing changes in regional research support for individual commodity groups is that provided by the changes in real funding (tables 4(b) and 5(b)). Among the commodities with highest levels of RRF support in 1975, beef cattle, water, community development, human resource development, cotton, marketing systems and sectors, air and climate and recreational resources, all were impacted by declines in real (1982) dollars of 40 percent or more between 1975 and 1990 (table 4(b)). In fact, three of these commodity groups, recreation resources, marketing systems and sectors, and air and climate had been displaced from the top funded 24 by 1990. Potatoes joined the highest funded group in 1990 with more than \$750,000 in RRF support, while 1) the Farm as a Business and 2) Research on Research Management moved up from the list of the 10 lowest funded commodities to join the lower end of the top 24 group.

Among the commodities with highest levels of RRF support in 1975, only three, 1) soybeans, 2) vegetables, and 3) small fruits and nuts received real funding increases of more than 10 percent by 1990. Among the lowest funded commodities in 1975, however, all but three (bees and honey, tobacco and foreign economics) received increases in real funding support of 90 percent or more by 1990. Thus, there does appear to have been a tendency to increase funding support more than proportionally for most of the commodities with low funding support in 1975.

Although it is difficult to summarize the congruence of RRF support for individual commodities with articulated priorities, it appears that changes in RRF support given to 1) water, 2) air and climate, and 3) marketing systems and sectors, were short of the high priority generally

articulated in national priorities for these commodity categories. Changes in RRF support for other commodity categories appears to be generally consistent with articulated priorities.

Among the commodity groups presented in tables 4(a) and 5(a), several, most notably 1) research on research management and 2) research on family and family members, generated rather low levels of funding leverage from Hatch RRF. This is probably not surprising since these are research topics which do not lend themselves to strong financial support from other sources. Moreover, these low leverage numbers should not be considered as effective measures of the priority which should be assigned these research topics for RRF support.

Changes in RRF Support for Individual

Commodities by Region, 1975-1990

Research priorities rather clearly differ for each of the four U.S. regions. As a consequence, we have ordered the high 24 RRF support commodities in 1990 for each region and traced the changes in funding for each commodity from 1975 to 1990.

It should be re-emphasized that judging the congruence between articulated priorities and the allocation of RRF support requires evaluation of both the original (1975) level of funding support and changes in that support over time. Since discussion of each commodity in each region would be excessively space consuming, only some highlight comments are included in the sections below. Because percentage changes in funding are calculated in nominal terms, it is important to keep in mind that a dollar increase of about 173 percent is required in 1990 just to retain the real dollar value of 1975 funding.

North Central Region

The top 24 ranked commodities for 1990 in the NC region are shown in table 6(a) together with percentage changes from 1975. Only 7 commodity groups received real increases in funding between 1975 and 1990. In order of greatest percentage increases they are plants, small fruits and nuts, vegetables, food, the family & its members, air & climate and sheep & wool. Funding for an eighth commodity group, the U.S. agricultural economy, increased at almost exactly the rate of inflation. Three additional commodity groups, the farm as a business, research on research management, and animals, moved from zero funding in 1975 to levels of between \$100 thousand and \$200 thousand in 1990. In terms of absolute funding levels, traditional "high value" livestock commodities continued to have the highest levels of funding. Thus there is a high level of congruence between the value of production for a commodity and its financial support level. The water and soil & land commodity categories, generally acknowledged to be of high priority, increased at less than the rate of inflation.

As might be expected, changes in RRF support for individual commodities fluctuated considerably when measured at discrete five-year intervals from 1975 to 1990. Individual regional research projects have their own life cycles of start-up, peak operation and wind-down. Moreover the 1975 base support for individual commodities varied greatly. Thus percentage changes in funding levels should be viewed with some discretion. Moreover, as shown in the last row of table 6(a), though total nominal dollar RRF support increased substantially from 1975 to 1980 and from 1980 to 1985, it actually decreased from 1985 to 1990.

TABLE 6(a)

1990 RRF Support for top 24 Commodity Groups and Percent Changes Since 1975

(North Central Region)

Commodity	Rank	Hatch RRF 1990 (thous. \$)	% Change 1975-80	% Change 1975- 85	% Change 1975-90
Dairy Cattle	1	938	112.3	125.5	156.8
Beef Cattle	2	765	96.3	203.4	113.4
Swine	3	758	27.8	16.6	93.9
Poultry	4	619	54.7	43.1	80.8
Corn	5	588	106.9	141.1	122.9
Forage Crops	6	552	72.8	94.2	75.6
Soil and Land	7	482	22.4	162.1	95.0
Vegetables	8	367	119.0	516.0	787.1
Food	9	354	169.5	268.1	390.1
Soybeans	10	348	237.2	326.5	309.0
Small Fruits & Tree Nuts	11	301	257.9	631.1	1,026.1
Plants	12	275	907.9	2,016.6	2,123.9
Sheep & Wool	13	259	65.8	141.0	204.2
Water	14	229	-39.7	9.0	9.9
Potatoes	15	193	58.7	107.5	25.2
The Family and its Members	16	192	241.3	288.8	333.2
The Farm as a Business	17	181	*	*	*
Research on Research Management	18	171	*	*	*
Wheat	19	154	52.3	103.1	-3.5
Air & Climate	20	146	61.9	124.8	234.6
Animals	21	138	*	*	*
People as Workers, Consumers, etc.	22	121	-36.4	-41.1	-30.3
Agricultural Economy	23	120	19.7	292.7	173.2
Trees	24	118	42.3	89.8	70.7
Total (All Commodities)	25	9,310	72.0	136.5	130.5

* Commodity had zero RRF support in 1975.

North East Region

The pattern of RRF support for individual commodities in the NE region (table 6(b)) differs substantially from the NC, but the two major livestock commodities, dairy and poultry, along with small fruits and nuts, are the top three. Among those commodity groups with funding of \$100 thousand or more in 1990, only water, soil and land, trees, ornamentals and turf and corn had real dollar increases between 1975 and 1990. People as workers & consumers and communities, areas & regions, fared the most poorly with major declines in real funding support.

Compared to the NC Region, beef cattle and traditional field crop commodities received much lower priority in funding allocations in the NE. This reflects the much lower value levels for these commodities and their declining prominence in the region's agriculture. Funding levels for water and for air & climate research appear low relative to the priority generally being currently assigned to these commodity categories. Although these research areas may not be of critical importance for agriculture in this region, they probably warrant high priority from a broader societal perspective.

Southern Region

As in the case of the NC region, the four major livestock commodity groups top the list for 1990 RRF support (table 6(c)). Moreover, poultry, swine and dairy all received real funding increases between 1975 and 1990. RRF support for beef cattle research, on the other hand, declined substantially in real dollars. These funding changes appear to be generally congruent with changes in total economic values for commodity groups.

TABLE 6(b)

1990 RRF Support for top 24 Commodity Groups and Percent Changes Since 1975

(North East Region)

Commodity	Rank	Hatch RRF 1990 (thous. \$)	% Change 1975-80	% Change 1975-85	% Change 1975-90
Small Fruits & Tree Nuts	1	725	31.8	73.4	95.9
Poultry	2	707	62.8	65.5	97.4
Dairy Cattle	3	660	109.6	195.7	157.6
Vegetables	4	552	119.5	192.9	116.9
Soil and Land	5	498	129.1	97.4	208.6
Plants	6	479	17.0	77.1	94.1
Potatoes	7	435	28.2	122.6	161.6
Food	8	420	95.1	108.0	153.2
Trees	9	409	122.4	244.3	215.5
Communities, Areas & Regions	10	333	-33.3	50.2	1.4
Ornamentals & Turf	11	306	88.1	134.6	235.4
Forage Crops	12	282	50.9	153.6	75.5
Corn	13	203	-2.6	85.5	192.6
Invertebrates (insects, etc)	14	116	*	*	*
Water	15	108	-11.0	24.7	307.1
People as Workers, Consumers, etc.	16	95	60.4	8.6	-26.8
Beef Cattle	17	95	61.7	43.1	69.8
Structures & Facilities	18	92	*	*	*
Soybeans	19	80	322.1	194.6	404.9
Animals	20	74	*	*	*
Air & Climate	21	56	48.4	440.3	234.6
Microorganisms, Viruses, etc.	22	54	-100.0	2,804.6	5,148.7
Wheat	23	49	*	*	*
Fish, Shellfish, Game & Fur Animals, etc.	24	43	21.6	255.4	20.1
Total (All Commodities)	25	7,138	54.5	112.5	110.9

* Commodity had zero RRF funding in 1975.

TABLE 6(c)

1990 RRF Support for top 24 Commodity Groups and Percent Changes Since 1975

(Southern Region)

Commodity	Rank	Hatch RRF	% Change	% Change	% Change
		1990 (thous. \$)	1975-80	1975-85	1975-90
Beef Cattle	1	882	31.2	117.3	7.4
Poultry	2	838	233.5	244.2	536.8
Dairy Cattle	3	813	107.3	146.9	194.9
Swine	4	792	129.8	302.7	370.3
Soil & Land	5	665	-0.3	94.8	253.8
Soybeans	6	662	468.8	544.6	425.6
Vegetables	7	604	77.5	214.1	281.3
Small Fruits & Tree Nuts	8	537	286.5	473.5	645.9
Cotton	9	426	65.7	45.7	26.0
Water	10	391	-28.0	-27.9	60.7
Forage Crops	11	391	125.5	189.6	191.6
Plants	12	211	59.3	64.6	75.1
Watersheds & River Basins	13	207	45.6	-52.0	-37.9
Ornamentals & Turf	14	203	70.5	5.4	78.6
Weeds	15	165	*	*	*
Corn	16	160	153.2	245.3	37.6
The Farm as a Business	17	157	3,297.8	4,502.4	5,871.6
Food	18	157	112.7	39.6	-4.1
Structures & Facilities	19	153	-39.0	-13.2	61.2
People as Workers, Consumers, etc.	20	153	65.0	110.0	-6.4
Miscellaneous & New Crops	21	152	46.5	119.3	219.3
Communities, Areas & Regions	22	148	-15.4	38.4	-22.2
Grain Sorghum	23	139	-1.8	36.9	189.9
Agricultural Economy	24	115	*	*	*
Total All Commodities		10,399	71.5	126.9	124.5

* Commodity had zero RRF funding in 1975.

Several traditional cash crops, soybeans, cotton, corn and grain sorghum are included in the list of the top 24 commodities along with vegetables, small fruits & tree nuts and ornamentals & turf. Changes in RRF support are generally congruent with economic values and reflect the increasing economic importance of soybeans and the declining role of cotton in much of the region.

The highest rates of percentage increases were realized for the farm as a business, small fruits and tree nuts, poultry and soybeans. Weeds and the agricultural economy with no RRF support in 1975, joined the top 24 list in 1990.

Relative to the NE Region, RRF support reflects the continued importance of crop and livestock agriculture in the Southern Region as was true for the NC Region as well.

Western Region

The list of top 24 commodity groups for the Western region is substantially different than for other regions illustrating the heterogeneity in both revenue and nonrevenue commodities in that region (table 6(d)). Among the top 24 commodities in 1990, sixteen received real dollar increases in RRF support between 1975 and 1990.

The highest percentage increases in funding were for swine, family & family members, vegetables, microorganisms, viruses, etc., and range, in that order. Among the high priority natural resource commodity groups, water received a less than average increase in RRF support and funding for soil and land declined, even in nominal dollars. Because of strong base funding in 1975, however, both categories remained in the top six.

TABLE 6(d)

1990 RRF Support for top 24 Commodity Groups and Percent Changes Since 1975

(Western Region)

Commodity	Rank	Hatch RRF	% Change	% Change	% Change
		1990 (thous. \$)	1975-80	1975-85	1975-90
Beef Cattle	1	845	49.4	42.2	-8.6
Small Fruits & Tree Nuts	2	812	150.0	248.3	309.0
Vegetables	3	626	368.9	443.1	549.2
Water	4	594	-28.1	12.2	80.7
Forage Crops	5	556	23.1	141.6	161.7
Soil & Land	6	410	-9.5	17.9	-17.5
Dairy Cattle	7	390	174.4	254.7	194.6
Sheep & Wool	8	333	-15.5	25.8	42.3
Food	9	316	235.7	322.9	338.3
Other Small Grains	10	244	72.3	233.1	367.0
Trees	11	238	43.0	62.1	227.1
Plants	12	217	169.3	225.0	198.5
Cotton	13	198	67.9	346.2	274.1
Wheat	14	191	120.7	259.1	206.2
The Family & its Members	15	180	375.6	652.8	575.9
People as Workers, Consumers, etc.	16	175	19.8	27.6	20.0
Range	17	158	128.8	428.6	482.3
Swine	18	154	32.5	461.8	623.2
Other Animals	19	135	-19.3	99.2	188.3
Recreation Resources	20	101	5.4	28.2	66.9
Poultry	21	96	804.2	364.6	373.0
Communities, Areas & Regions	22	97	-36.0	16.3	-10.1
Potatoes	23	95	-0.8	356.5	461.3
Microorganisms, Viruses, etc.	24	92	14.1	362.0	554.9
Total All Commodities		8,356	56.0	113.1	113.5

* Commodity had zero RRF funding in 1975.

In Summary

The CRIS data base available for evaluation of RRF support for research in specific regions is less than ideal. Problems include those of research classification and accuracy of the data reported. Yet, the relative levels of RRF support in each region does appear highly congruent with available perspective on regional priorities. It may be the case, however, that some of the commodity groups with lower priority and lower funding levels should be closed out. If so, some of the current priority areas, e.g., biotechnology, environmental quality and resource sustainability, and trade competitiveness could be allocated additional funding support.

The Current Portfolio of Agricultural

Economics Regional Research

Effective future evaluation of the congruence between funding for regional research and articulated research priorities will require systematic reporting by the SAES of funding for research program (problem) areas which are reflective of the research categories comparable to those from which current priorities are established. This could be done by selective splitting of existing RPAs so that new data categories could be developed while still permitting the retention of existing data series. Several special classifications have been established from existing CRIS data bases. These include those for research on water resources, energy, pesticide targets, integrated pest management, range and pasture, and agricultural economics. For most, however, the time series is so short so as to preclude analysis of changes in funding allocations over time. But, a brief presentation of the data on agricultural economics research is included here for

preliminary review. The numbers cited are for research conducted in agricultural economics departments in Land Grant Universities.

As a percent of total agricultural economics research in 1989, regional research was 18.1 percent for the North Central Region, 37.3 for the North East, 29.9 for the South and 26.8 for the West. Thus, as a percent of total research, regional research in the North East is proportionately about double that of the North Central Region. This would appear to be a logical relationship given the preponderance of small states in the North East. Both the severe rationing of total research funding and the general similarity of rural economic conditions among states in the North East argue for a higher proportion of regional research.

Table 7 shows the percentage allocation of regional research budget support for 12 program categories and for other specialties. Fund allocations for the North East Region show a much lower level of support for most program areas associated with commercial agriculture. The percentage of funding for community resource economics is, however, much larger for the North East reflecting the increased importance of economic issues not focused on commercial agriculture.

Relative to articulated research priorities, the percentage funding support for natural resource and environmental economics in Agricultural Economics departments appears low as does support for international trade and development in the North Central Region. The latter program category is, appropriately, not a high priority in the North East. In all regions, Farm Management and Production Economics research has declined relatively as a priority in recent years and funding allocations to this program area in 1989 appear to be generally in line with that decline in priority.

TABLE 7

Percentages of Regional Agricultural Economics Research Expenditures
for Different Program Areas, 1989*

<u>Program Area</u>	<u>Region</u>			
	North Central	North East	South	West
Farm Management & Production Economics	7.6	3.0	9.6	6.9
Agricultural Marketing	24.5	17.4	28.4	22.2
Agribusiness Management	1.8	4.3	3.1	2.6
Agricultural Price, Income & Policy Analysis	21.9	11.6	15.2	15.1
International Trade and Development	4.2	0.5	9.9	7.9
Agricultural Finance	18.5	10.1	5.1	8.5
Natural Resource & Environmental Economics	2.6	8.4	3.9	10.7
Community Resource Economics	4.8	31.3	5.1	10.9
Human Resource Economics	0.5	0.5	0.3	0.6
Consumer Economics	8.1	2.3	7.9	6.3
Economic Theory	1.5	4.8	1.9	2.0
Research Methods	4.0	5.3	4.6	4.0
Other Specialties	0	1.5	4.9	2.4

* Totals may not check to 100.0 percent due to rounding.

Allocation of Regional Funding Support for

Applied, Basic and Developmental Research

There are no well articulated priorities for the proportion of national and regional research funds which should be allocated to basic, applied and developmental research.

There is, however, a general consensus that with increased funding of applied and developmental agricultural research by the private sector, and with a decline in real public research funding, an increased proportion of public funding should be directed to research in the basic sciences.

As of 1975, 61.9 percent of RRF support went for applied, 32.9 percent for basic and 5.2 percent for developmental research (tables 8(a), 8(b) and 8(c)). In nominal dollars, funding for basic research increased by 167.7 percent compared to 93.5 and 137.7 percent for applied and developmental research respectively by 1990. Since the proportion of research classified as developmental is very small, a very modest change in funding translates into a large percentage change. In real (1982 dollar) terms, changes in RRF support from 1975 to 1990 were -1.9, -29.1 and -12.9 percent respectively for basic, applied and development research.

In 1975, other sources of financial support, including state appropriations, allocated a lower proportion of funds to basic and a higher proportion to applied research than was the case for RRF. As a result, the percentage of total funding in 1975 for regional research was 69.2 percent applied, 27.2 percent basic and 3.6 developmental. But, between 1975 and 1990, virtually all other sources of funding shifted even more strongly to supporting basic research than was the case for RRF. As a result, in 1990 40.9 percent of total regional research expenditures went for basic research compared to 40.0 percent of RRF support. And, 53.3 percent of total regional research expenditures went for

TABLE 8(a)

Percent of Regional Research Funding for Applied Research,
1975 Base and Percent Change 1975-90

CRIS Research Goals	Geographic Region	1975 Hatch RRF (% Applied)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$	1975 State Appropriated Funds for RR (% Applied)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$	1975 Total Expenditures for RR (% Applied)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$
1. Natural Resource Management	U.S.	62.9	263.5	33.2	63.2	686.8	188.3	63.7	544.9	136.3
2. Plant and Animal Protection	U.S.	52.2	154.6	-6.7	50.9	475.3	110.8	50.8	343.0	62.3
3. Production Cost Reduction	U.S.	65.3	117.7	-20.2	63.2	295.5	44.9	65.3	203.6	11.3
4. New and Improved Products	U.S.	54.4	102.5	-25.8	57.4	527.8	130.0	56.9	305.0	48.4
5. Marketing Efficiency	U.S.	74.2	31.6	-51.8	72.4	630.4	167.6	74.1	206.3	12.2
6. Foreign Trade and Development	U.S.	55.5	1,750.2	577.9	61.3	57,305.2	20,934.2	63.2	8,678.9	3,116.7
7. Consumer Health and Nutrition	U.S.	51.1	67.4	-38.7	55.5	296.7	45.4	52.4	238.2	23.9
8. Improved Family Living	U.S.	67.3	108.7	-23.5	60.7	851.9	248.8	64.7	443.0	99.0
9. Rural Development	U.S.	66.1	-23.4	-71.9	89.2	-45.2	-79.9	86.0	-49.0	-81.3
All	U.S.	61.9	93.5	-29.1	71.2	193.1	7.4	69.2	145.2	-10.2
All	NC	61.7	93.5	-29.1	81.2	71.1	-37.3	75.9	90.7	-30.1
All	NE	58.9	83.9	-32.6	66.2	272.5	36.5	63.1	190.7	6.5
All	S	64.0	106.8	-24.2	67.5	283.5	40.5	67.9	182.3	3.5
All	W	62.1	84.8	-32.3	61.8	289.9	42.9	64.9	163.9	-3.3

TABLE 8(b)

Percent of Regional Research Funding for Basic Research,
1975 Base and Percent Change 1975-90

CRIS Research Goals	Geographic Region	1975 Hatch RRF (% Basic)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$	1975 State Appropriated Funds for RR (% Basic)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$	1975 Total Expenditures for RR (% Basic)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$
1. Natural Resource Management	U.S.	30.8	380.3	76.0	32.7	931.7	278.0	31.4	819.3	236.8
2. Plant and Animal Protection	U.S.	43.3	199.8	9.9	43.7	613.1	161.3	43.9	473.2	110.0
3. Production Cost Reduction	U.S.	32.1	258.1	31.2	33.3	506.3	122.2	32.1	399.1	82.9
4. New and Improved Products	U.S.	41.1	105.2	-24.8	35.4	577.7	148.3	37.5	309.1	49.9
5. Marketing Efficiency	U.S.	21.6	32.1	-51.6	21.9	612.4	161.0	21.0	232.2	21.7
6. Foreign Trade and Development	U.S.	42.5	766.3	217.4	37.1	35,401.9	12,908.5	35.3	6,449.0	2,299.7
7. Consumer Health and Nutrition	U.S.	35.4	96.3	-28.1	40.2	322.0	54.6	40.1	260.2	32.0
8. Improved Family Living	U.S.	24.0	139.8	-12.1	31.4	721.0	200.8	27.7	436.6	96.6
9. Rural Development	U.S.	28.4	1.1	-63.0	9.3	239.3	24.3	11.8	132.4	-14.8
All	U.S.	32.9	167.7	-1.9	25.4	516.8	126.0	27.2	379.9	75.8
All	NC	32.7	196.0	8.5	15.7	609.0	159.8	20.8	421.6	91.1
All	NE	34.9	164.9	-2.9	31.4	546.0	136.7	33.2	356.4	67.2
All	S	30.8	147.6	-9.3	28.7	437.0	96.8	28.1	319.3	53.6
All	W	33.9	163.8	-3.3	34.3	508.5	123.0	31.5	423.9	92.0

TABLE 8(c)

Percent of Regional Research Funding for Developmental Research,
1975 Base and Percent Change 1975-90

CRIS Research Goals	Geographic Region	1975 Hatch RRF (% Dev.)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$	1975 State Appropriated Funds for RR (% Dev.)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$	1975 Total Expenditures for RR (% Dev.)	% Change 1975-90 Nominal \$	% Change 1975-90 1982 \$
1. Natural Resource Management	U.S.	6.3	476.8	111.3	4.1	1,173.6	366.7	4.9	791.8	226.8
2. Plant and Animal Protection	U.S.	4.5	192.9	7.3	5.4	504.1	121.3	5.3	372.7	73.2
3. Production Cost Reduction	U.S.	2.6	308.7	49.7	3.5	607.7	159.3	2.6	613.4	161.4
4. New and Improved Products	U.S.	4.5	255.9	30.4	7.2	810.5	233.6	5.5	624.7	165.6
5. Marketing Efficiency	U.S.	4.2	56.2	-42.8	5.7	744.5	209.5	4.9	278.4	38.7
6. Foreign Trade and Development	U.S.	2.0	1,770.0	585.2	1.7	68,076.9	24,881.2	1.5	14,182.2	5,133.2
7. Consumer Health and Nutrition	U.S.	13.6	0.6	-63.1	4.3	404.4	84.8	7.5	142.0	-11.3
8. Improved Family Living	U.S.	8.8	-10.1	-67.1	8.0	731.1	204.5	7.6	337.8	60.4
9. Rural Development	U.S.	5.5	22.6	-55.1	1.6	418.2	89.9	2.2	215.2	15.5
All	U.S.	5.2	137.7	-12.9	3.3	602.7	157.5	3.6	412.6	87.8
All	NC	5.5	144.1	-10.5	3.1	471.3	109.3	3.3	447.0	100.4
All	NE	6.2	63.9	-40.0	2.4	697.7	192.3	3.7	266.2	34.2
All	S	5.2	192.3	7.1	3.8	826.9	239.6	3.9	519.7	127.1
All	W	4.0	143.6	-10.7	3.9	469.0	108.5	3.6	322.6	54.9

applied research compared to 54.3 percent of RRF support. Thus it appears that the shift to a proportionate increase in basic research occurred more slowly for RRF support than for other funding sources.

Among the 9 CRIS research goals, the highest proportion of RRF allocations for basic research in 1975 (more than 40 percent) occurred for plant and animal protection, new and improved products, and foreign trade and development. Lowest percentages (less than 25 percent) went for marketing efficiency and improved family living. In 1990, plant and animal protection, production cost reduction, new & improved products, and consumer health & nutrition were all research goal categories with RRF support for basic research of 40 percent or more. Research in support of several of these research goals involves major inputs from chemistry and biology. Thus the actual proportional allocations of RRF support appear consistent with the relative needs for basic work within the several research goal categories. And, although the proportion of RRF support for basic and applied research differs modestly among regions, these differences are not enough to suggest major differences in the priorities assigned to basic and applied research.

Distribution of Regional Research Funds for Individual Projects

As shown in table 9, the amount of Hatch RRF support provided to individual SAES projects varies greatly both absolutely and relative to total project funding. Of the 2,116 individual regional research projects in 1990, 1,044 or 49.3 percent had RRF support of \$10,000 or less. This constituted less than 4.5 percent of total funding for these projects. And a sampling inspection indicates that a high proportion of RRF support for these projects went for travel and miscellaneous (non salary) expense. Thus the major functional

Table 9

Distribution of Regional Research Funds by Individual Projects, 1990

Category (dollars)	Number of Projects	Hatch RRF Funds	Total Funds	% RRF
0-500	366	\$9,424	\$26,835,804	0
501-2500	176	\$240,929	\$7,745,941	3
2501-10000	502	\$3,167,678	\$41,709,572	8
10001-25000	648	\$10,616,473	\$62,626,195	17
25001-50000	307	\$10,673,980	\$48,729,074	22
50001-100000	91	\$5,922,291	\$22,138,566	27
100001-250000	22	\$3,171,465	\$7,635,387	42
250001-n	4	\$1,400,602	\$2,595,654	54
Total	2116	\$35,202,842	\$220,016,193	16

purpose served by RRF support for most of these projects was that of improved communication (science and technology transfer) among researchers.

At the other extreme, RRF support for 26 individual projects exceeded \$100,000 per project and constituted, on average, about 45 percent of total funding for these projects. The latter group comprises some very large research projects, several of which are interregional projects for which RRF support played a dominant role.

For those individual projects with RRF support ranging from \$10,001 to \$100,000, the RRF contribution constituted 20.4 percent of total project funding and included salary, travel and operational support.

One conclusion to be reached from reviewing the distribution of total funding for individual projects is that evaluation of the effectiveness of (benefits from) RRF support should consider the functions being serviced in the regional research enterprise. Creation of new knowledge is not the only function of regional research. Rather clearly some weight in evaluation should also be given to the function of science and technology transfer.

Optimum Duration of Regional Research Projects

There are no simple answers to the question of the best duration period for regional research projects. Analysis of the portfolio of existing projects identified some research topics which are continuing ones and some for which a specific research work program and time frame was clearly identified in the project proposal. Examples of the former include more generic projects related to improved water quality, plant and animal biotechnology, conservation of natural resources, assessing changes in the structure of agricultural production or marketing, etc. Examples of projects of more readily specified duration are those of scientific and/or socio-economic evaluation of individual technologies and/or problem areas. A common characteristic of this latter type of project is that it is more specific vis-a-vis technology, pest, commodity, market, etc. Thus it is easier to bound the content of research and the time requirements for completion. As a result, it is difficult to specify a single optimum time frame (limit) for project duration. Moreover, specifying an "average" time frame for all projects would appear undesirable. As a minimum, for time duration evaluation purposes, regional research projects should probably be placed into the two above-mentioned categories.

For those regional projects with a continuing agenda, the following evaluation procedure might be appropriate:

- 1) Does the project topic fall within the category of very high priority research?
- 2) If the answer is yes, within what time frame is an evaluation of continuing project performance feasible? A minimum time period of 3 to 5 years is probably likely.
- 3) At the time of project evaluation several questions should be raised including those of continuing research priority, project productivity and general effectiveness of the regional research format.
- 4) Periodically, and probably at the time of each project renewal, a modest peer evaluation of the project should probably be undertaken. As in virtually all human endeavors, vested interests develop over time and evaluative objectivity by project participants is difficult. This includes the difficulty of specifying needed project revisions.
- 5) Project renewal, when appropriate should probably not exceed 4 to 5 years.

For those regional projects with a more readily specifiable time frame for conduct, generally 3 to 4 years, project duration should probably be limited to this specified period with a maximum extension of 1 to 2 years, primarily for publication purposes, but with no project revision or renewal. An informal review of regional research projects with well defined research tasks and procedures indicates that, for many, although most research is essentially completed within a 3 year period, the time lag for publication extends necessary project life another 12 to 18 months.

Finally, an informal review of regional research projects for a small sample of SAES indicates that the duration rate of projects is somewhat disciplinary (department) related. Moreover, this appears to be at least somewhat related to how general (specific) the project is written in terms of research objectives and procedures. Thus effective administration of regional research projects, vis-a-vis timeliness of project completion, may require imposition of tighter uniformity for project guidelines across disciplines.

A Process for the Selection and Development of NRPs and NRSPs

Prioritization, selection and development of NRPs and NRSPs is obviously a question of substantial complexity and for which there are no simple answers. Perhaps the most difficult problem is that of quantifying the importance of many research areas/topics even on a relative basis. As an example, it is difficult to compare the potential benefits from research to increase soybean yields with that for improving water quality and/or enhancing community economic development. At least for now, one must rely on a very subjective process for setting national research priorities. The following is a proposed sequential procedure which might be employed in the process of prioritizing national research efforts:

1. Retention of a fairly open process for nominating candidates for NRPs and NRSPs. This includes a systematic solicitation of candidates from individual SAES, Regional Research Committees and Regional and National Committees of the SAES.
2. Development of a short list of projects by comparing proposals against a list of high priority research areas. In the case of NRSPs, consideration needs to be given to the question of whether or not the essential effort could (and would) be accomplished without an NRSP.
3. A shortened list of perhaps 8 to 10 NRPs and 3 to 5 NRSPs should then be subjected to more detailed analysis and evaluation of a "technology assessment" type. Among the most important issues for analysis are the following:
 - (a) The importance of the proposal in terms of:
 - (i) Magnitude of economic impact as measured by a gross benefit/cost analysis, evaluation of the number of people and/or firms affected, and potential effects on income (including distribution) and competitiveness,
 - (ii) environmental effects
 - (iii) implications for food safety and human nutrition,
 - (iv) other societal implications, e.g., structural, legal, etc.
 - (v) effects on other research programs (particularly for NRSPs)
 - (b) The timeliness of the project including an evaluation of the adverse consequences of not undertaking the research project.
 - (c) Resource feasibility (are the personnel and financial resources available to do the project effectively)?
 - (d) Organizational feasibility (is the proposed organizational and administrative structure such that the project will be well organized and managed)?
 - (e) Overall likelihood of project success.
4. Final selection of NRPs and NRSPs by C/9 in consultation with ESCOP and, perhaps, other committees of the SAES.

Rather clearly for some NRPs and some NRSPs one or more of the suggested components of analysis and evaluation will not be of significant importance. Yet a systematic check list of evaluative criteria seems highly desirable. Two important questions seem to persist in the process of project selection and development:

1. Will the selection process involve any systematic formal (or informal) analysis somewhat akin to a simplified technology assessment of alternatives?
2. If so, how will such analysis be organized and managed?

Before undertaking any detailed planning in response to question 2, it is probably important to develop at least a tentative response to question 1.

APPENDICES

A. CRIS RESEARCH PROBLEM AREAS (RPAs)

GOAL I: INSURE A STABLE AND PRODUCTIVE AGRICULTURE FOR THE FUTURE THROUGH WISE MANAGEMENT OF NATURAL RESOURCES

- 101 Appraisal of Soil Resources
- 102 Soil, Plant, Water, Nutrient Relationships
- 103 Management of Saline and Sodic Soils and Salinity
- 104 Alternative Uses of Land
- 105 Conservation and Efficient Use of Water

- 106 Efficient Drainage and Irrigation Systems and Facilities
- 107 Watershed Protection and Management
- 108 Economic and Legal Problems in Management of Water and Watersheds
- 109 Adaptation to Weather and Weather Modification
- 110 Appraisal of Forest and Range Resources

- 111 Biology, Culture and Management of Forests and Timber-Related Crops
- 112 Improvement of Range Resources
- 113 Remote Sensing
- 114 Research on Management of Research

GOAL II: PROTECT FORESTS, CROPS AND LIVESTOCK FROM INSECTS, DISEASES AND OTHER HAZARDS

- 201 Control of Insects Affecting Forests
- 202 Control of Diseases, Parasites and Nematodes Affecting Forests
- 203 Preventions and Control of Forest and Range Fires
- 204 Control of Insects, Mites, Slugs, and Snails on Fruit and Vegetable Crops
- 205 Control of Diseases and Nematodes of Fruit and Vegetable Crops
- 206 Control of Weeds and other Hazards to Fruit and Vegetable Crops
- 207 Control of Insects, Mites, Snails, and Slugs affecting Field Crops and Range
- 208 Control of Diseases and Nematodes of Field Crops and Range
- 209 Control of Weeds and other Hazards of Field Crops and Range
- 210 Control of Insects and External Parasites affecting Livestock, Poultry and other Animals
- 211 Control of Diseases of Livestock, Poultry and other Animals
- 212 Control of Internal Parasites of Livestock, Poultry, and other Animals
- 213 Protect Livestock, Poultry and other Animals from Toxic Chemicals, Poisonous Plants, and other Hazards
- 214 Protection of Plants, Animals, and Man from Harmful effects of Pollution

**GOAL III: PRODUCE AN ADEQUATE SUPPLY OF FARM AND FOREST PRODUCTS AT
DECREASING REAL PRODUCTION COSTS**

- 301 Genetics and Breeding of Forest Trees
- 302 New and Improved Forest Engineering Systems
- 303 Economics of Timber Production
- 304 Improvement of Biological Efficiency of Fruit and Vegetable Crops
- 305 Mechanization of Fruit and Vegetable Crop Production

- 306 Production Management Systems for Fruits and Vegetables
- 307 Improvement of Biological Efficiency of Field Crops
- 308 Mechanization of Production of Field Crops
- 309 Production Management Systems for Field Crops
- 310 Reproductive Performance of Livestock, Poultry and other Animals

- 311 Improvement of Biological Efficiency in Production of Livestock, Poultry and other Animals
- 312 Environmental Stress in Production of Livestock, Poultry and other Animals
- 313 Production Management Systems for Livestock, Poultry and other Animals
- 314 Bees and other Pollinating Insects
- 315 Improvement of Structures, Facilities and General Purpose Farm Supplies and Equipment

- 316 Farm Business Management
- 317 Mechanization and Structures used in Production of Livestock, Poultry and other Animals
- 318 Non-Commodity-Oriented Biological Technology and Biometry

**GOAL IV: EXPAND THE DEMAND FOR FARM AND FOREST PRODUCTS BY
DEVELOPING NEW AND IMPROVED PRODUCTS AND PROCESSES AND
ENHANCING PRODUCT QUALITY**

- 401 New and Improved Forest Products
- 402 Production of Fruit and Vegetable Crops with improved Acceptability
- 403 New and Improved Fruit and Vegetable Products and Byproducts
- 404 Quality Maintenance in Storing and Marketing Fruits and Vegetables
- 405 Production of Field Crops with Improved Acceptability

- 406 New and Improved Food Products from Field Crops
- 407 New and Improved Feed, Textile, and Industrial Products from Field Crops
- 408 Quality Maintenance in Storing and Marketing Field Crops
- 409 Production of Animal Products with Improved Acceptability
- 410 New and Improved Meat, Milk, Eggs, and other Animal Food Products
- 411 New and Improved Non-Food Animal Products
- 412 Quality Maintenance in Marketing Animal Products

GOAL V: IMPROVE EFFICIENCY IN THE MARKETING SYSTEM

- 501 Improvement of Grades and Standards--Crop and Animal Products
- 502 Development of Markets and Efficient Marketing of Timber and Related Products
- 503 Efficiency in Marketing Agricultural Products and Production*

- 506 Supply, Demand and Price Analysis--Crop and Animal Products
- 507 Competitive Interrelationships in Agriculture
- 508 Development of Domestic Markets for Farm Products
- 509 Performance of Marketing Systems
- 510 Group Action and Market Power

- 511 Improvement in Agricultural Statistics
- 512 Improvement of Grades and Standards of Forest Products
- 513 Supply, Demand and Price Analysis--Forest Products

GOAL VI: EXPAND EXPORT MARKETS AND ASSIST DEVELOPING NATIONS

- 601 Foreign Market Development
- 602 Evaluation of Foreign Food Aid Programs
- 603 Technical Assistance to Developing Countries
- 604 Product Development and Marketing for Foreign Markets

GOAL VII: PROTECT CONSUMER HEALTH AND IMPROVE NUTRITION AND WELL-BEING OF THE AMERICAN PEOPLE

- 701 Insure Food Products Free of Toxic Residues from Agricultural Sources
- 702 Protect Food and Feed Supplies from Harmful Microorganisms and Naturally Occurring Toxins
- 703 Food Choices, Habits and Consumption
- 704 Home and Commercial Food Service
- 705 Selection and Care of Clothing and Household Textiles

- 706 Control of Insect Pests of Man and his Belongings
- 707 Prevent Transmission of Animal Diseases and Parasites to Man
- 708 Human Nutrition
- 709 Reduction of Hazards to Health and Safety

GOAL VIII: ASSIST RURAL AMERICANS TO IMPROVE THEIR LEVEL OF LIVING

- 801 Housing
- 802 Individual and Family Decision making and Resource use and Family Functioning

* This RPA incorporates research Formerly included under RPA's 503, 504, and 505.

- 803 Causes of Poverty among Rural People
- 804 Improvement of Economic Potential of Rural People
- 805 Communication and Education Processes

- 806 Individual and Family Adjustment to Change
- 807 Structural Changes in Agriculture
- 808 Government Programs to Balance Farm Output and Market Demand

GOAL IX: PROMOTE COMMUNITY IMPROVEMENT INCLUDING DEVELOPMENT OF
BEAUTY, RECREATION, ENVIRONMENT, ECONOMIC OPPORTUNITY, AND
PUBLIC SERVICE

- 901 Alleviation of Soil, Water and Air Pollution and Disposal of Wastes
- 902 Outdoor Recreation
- 903 Multiple Use Potential of Forest Land and Evaluation of Forestry Programs
- 904 Fish and other Marine Life, Fur-Bearing Animals and other Wildlife
- 905 Trees to Enhance Rural and Urban Environment

- 906 Culture and Protection of Ornamentals and Turf
- 907 Improved Income Opportunities in Rural Communities
- 908 Improvement of Rural Community Institutions and Services

B. COMMODITIES, RESOURCES AND OTHER RESEARCH AREAS

- 0100 Soil and Land
- 0200 Water
- 0300 Watersheds and River Basins
- 0400 Air and Climate
- 0500 Recreational Resources
- 0600 Trees, Forests, and Forest Products (Excluding Edible Tree Nut Crops (see 1050) and Tung (see 2560))
- 0700 Range
- 0800 Fish, Shellfish, Game and Fur-Bearing Animals and Other Wildlife and their Habitats
- 0900 Citrus and Subtropical Fruit
- 1000 Deciduous and Small Fruits and Edible Tree Nuts
- 1100 Potatoes
- 1200 Vegetables
- 1300 Ornamentals and Turf
- 1400 Corn (Includes Popcorn). (For Sweetcorn see 1280)
- 1500 Grain Sorghum
- 1600 Rice
- 1700 Wheat
- 1800 Other Small Grains
- 1900 Pasture
- 2000 Forage Crops

- 2100 Cotton (Including Cottonseed for Plant Purposes)
- 2200 Cottonseed (For Meal, Oil, etc.)
- 2300 Soybeans
- 2400 Peanuts
- 2500 Other Oilseed and Oil Crops (Excluding Cottonseed)
- 2600 Tobacco
- 2700 Sugar Crops
- 2800 Miscellaneous and New Crops
- 2900 Poultry
- 3000 Beef Cattle
- 3100 Dairy Cattle
- 3200 Swine
- 3300 Sheep and Wool
- 3400 Other Animals (See 0850 for Fur-Bearing Animals)
- 3500 Bees and Honey and Other Pollinating Insects

MANMADE RESOURCES

- 3600 General Purpose Supplies
Includes: Machinery, Equipment, Fertilizers, Feedstuffs, and Pesticides
- 3700 Clothing and Textiles
- 3800 Food (Not readily associated with specific Plant and Animal Products)
- 3900 Structures and Facilities

HUMAN RESOURCES, ORGANIZATIONS AND INSTITUTIONS

- 4000 People as Individual Workers, Consumer and Members of Society
- 4100 The Family and its Members
- 4200 The Farm as a Business Enterprise
- 4300 Communities, Areas and Regions, including Counties and States and their Institutions and Organizations
- 4400 Agricultural Economy of United States and Sectors thereof, including Interrelationships with the Total Economy
- 4500 Agricultural Economy of Foreign Countries and Sectors thereof, including Interrelationships with the Total Economy
- 4600 Farmer Cooperatives
- 4700 Marketing, Processing and Supply Firms other than Cooperatives
- 4800 Marketing Systems and Sectors thereof

TECHNOLOGY NOT ASSOCIATED WITH SPECIFIC COMMODITIES OR RESOURCES

- 6100 Weeds
- 6200 Seed Research
- 6300 Biological Cell Systems

- 6400 Experimental Design and Statistical Methods
- 6500 Invertebrates (Including Insects, Mites, Ticks, Snails, Slugs, and Leeches)
- 6600 Microorganisms, Viruses, etc.
- 6700 Plants
- 6800 Animals (Vertebrates)
- 6900 Research on Research Management
- 7000 Research Equipment and Technology

C. RESEARCH PROGRAM GROUP (RPG)/RESEARCH PROGRAM (RP)

RPG 1.00 ANIMAL RESOURCES

- RP 1.01 Soil and Land Use
- RP 1.02 Water and Watersheds
- RP 1.03 Recreation
- RP 1.04 Environmental Quality
- RP 1.05 Weather Modification for Agriculture and Forestry
- RP 1.06 Fish and Wildlife
- RP 1.07 Remote Sensing
- RP 1.08 Aquatic Weeds
- RP 1.09 Natural Resources - General

RPG 2.00 FOREST RESOURCES

- RP 2.01 Inventory and Appraisal of Forest Resources
- RP 2.02 Timber Management
- RP 2.03 Forest Protection
- RP 2.04 Harvesting, Processing and Marketing Forest Products
- RP 2.05 Forest Watersheds, Soils, Pollution
- RP 2.06 Forest Range Wildlife and Fisheries Habitat Development
- RP 2.07 Forest Recreation and Aesthetics and other Landscape Values
- RP 2.08 Alternative Uses of Land
- RP 2.09 Technical Assistance
- RP 2.10 Trees, Forests and Forest Products - General
- RP 2.11 Forest and Range Resources

RPG 3.00 CROPS (Field and Horticultural)

- RP 3.01 Corn
- RP 3.02 Grain Sorghum
- RP 3.03 Wheat
- RP 3.04 Small Grains other than Wheat
- RP 3.05 Rice
- RP 3.06 Soybeans

- RP 3.07 Peanuts
- RP 3.08 Sugar
- RP 3.09 Forage, Range, and Pasture
- RP 3.10 Cotton
- RP 3.11 Tobacco
- RP 3.12 New Crops and Minor Oilseeds
- RP 3.13 Fruit
- RP 3.14 Vegetable Crops
- RP 3.15 Plants to Enhance the Environment
- RP 3.16 Bees and other Pollinating Insects
- RP 3.17 Weeds in Crops
- RP 3.18 Seeds
- RP 3.19 Nonspecific - Plants

RPG 4.00 ANIMALS

- RP 4.01 Beef
- RP 4.02 Dairy
- RP 4.03 Poultry
- RP 4.04 Sheep
- RP 4.05 Swine
- RP 4.06 Other Animals (Horses, Goats, Pets, Laboratory, etc.)
- RP 4.07 Aquatic Food and Feedstuffs
- RP 4.08 Nonspecific - Animals
- RP 4.09 Invertebrates

RPG 5.00 PEOPLE, COMMUNITIES, AND INSTITUTIONS INCLUDING RURAL DEVELOPMENT

- RP 5.01 Individuals and Families
- RP 5.02 Living Environment
- RP 5.03 Communities, Institutions and Services
- RP 5.04 Insects Affecting Man and his Belongings
- RP 5.05 Research on Administration of Research

RPG 6.00 COMPETITION, TRADE, ADJUSTMENT, PRICE AND INCOME POLICY

- RP 6.01 Farm Adjustment, Prices and Income
- RP 6.02 Foreign Agricultural Trade and Economic Development
- RP 6.03 Marketing and Competition

RPG 7.00 GENERAL RESOURCE OR TECHNOLOGY

- RP 7.01 Man-made Resources
- RP 7.02 Technology not Associated with Specific Commodities, Resources of RPGs

RPG 8.00 FOOD SCIENCE AND HUMAN NUTRITION

- RP 8.01 Human Nutrition
- RP 8.02 Food Processing
- RP 8.03 Food Safety
- RP 8.04 Food Storage, Distribution and Marketing
- RP 8.05 Food Service

D. RPA_s FOR REFORMULATED RESEARCH GOALS USED IN TABLES 3(a) AND 3 (b)

<u>Goal</u>	<u>RPA_s Included in Goal</u>
1. Foreign Market Expansion	601, 604
2. Food Safety	701, 702, 707
3. Natural Resources and Environment	105, 107, 108, 214, 901
4. Enhanced Biological Technology	304, 307, 311, 318
5. Human Nutrition and Consumer Choice	703, 708
6. Marketing Efficiency and Trade Competition	501, 502, 503, 507, 512, 601, 604
7. Human Capital Development	802, 804, 805, 806
8. Productivity Enhancement, Plants	201, 202, 203, 204, 205, 206, 207, 208, 209 301, 302, 303, 304, 305, 306, 307, 308, 309, 315, 906
9. Productivity Enhancement, Livestock	210, 211, 212, 213, 310, 311, 312, 313, 314, 317, 411, 904
10. Rural and Community Development	801, 803, 902, 903, 907, 908
11. New and Improved Products	401, 402, 403, 405, 406, 407, 409, 410, 411