



<http://www.beancap.org>

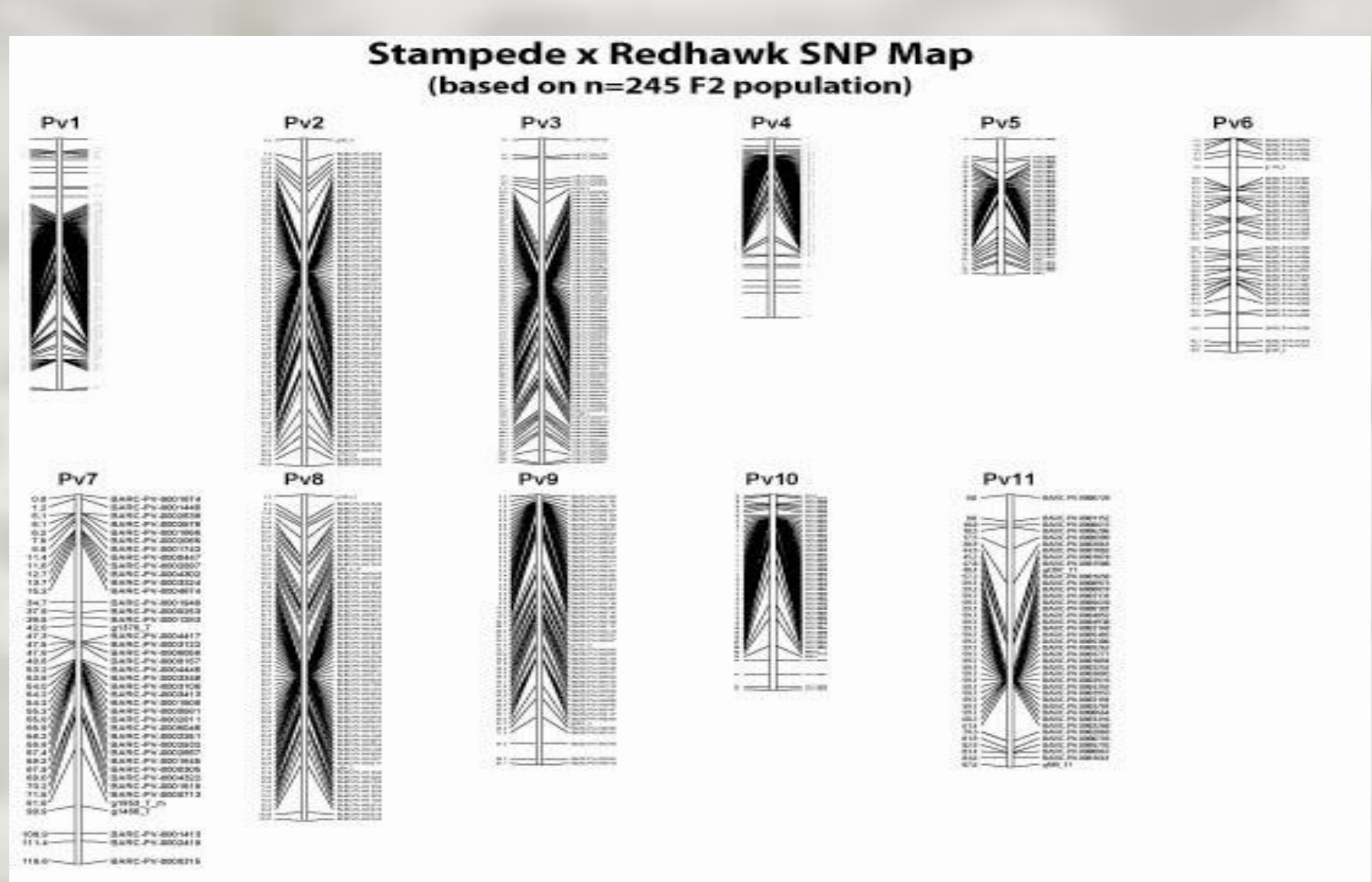
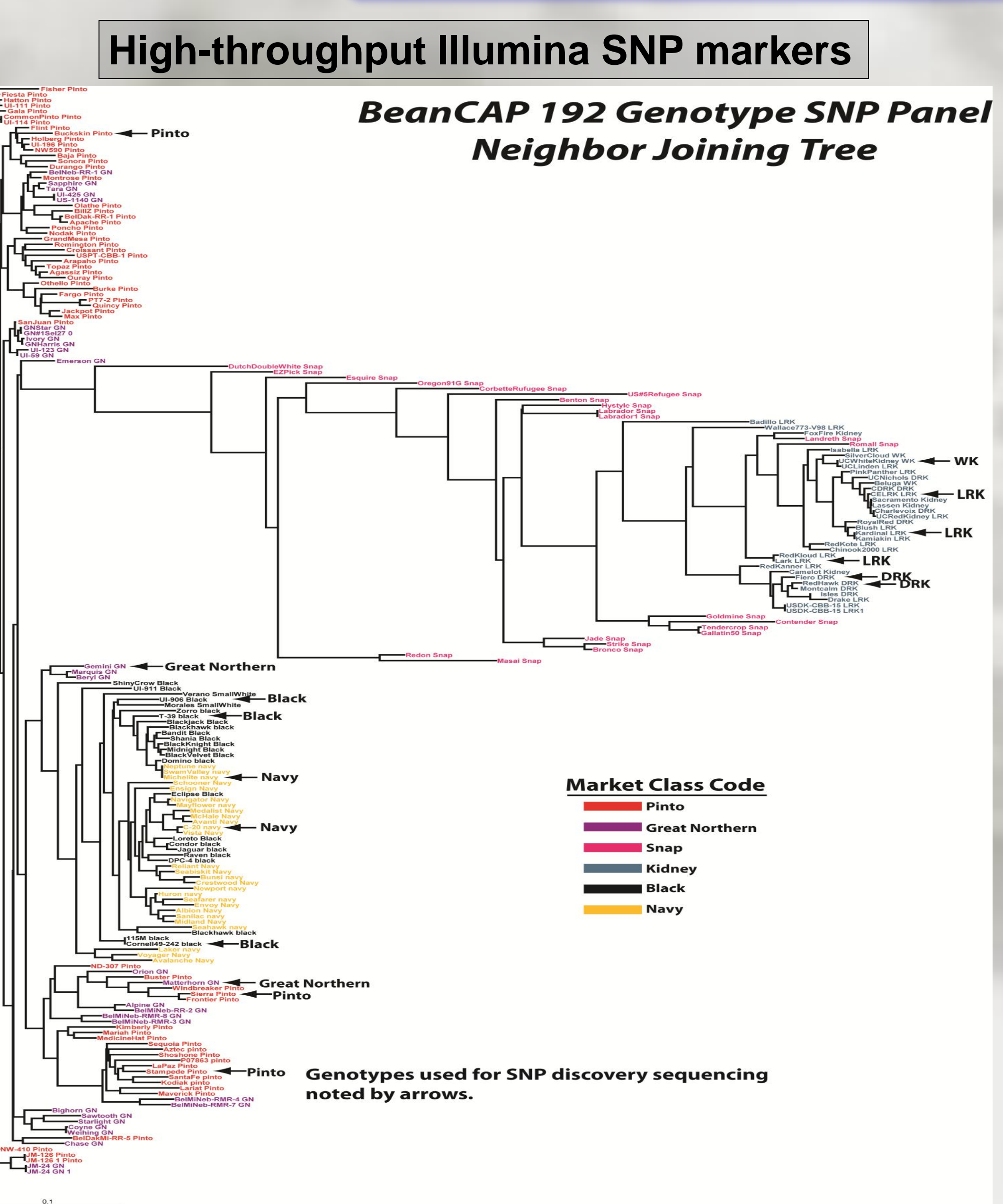
# THE BEANCAP PROJECT: IMPROVED NUTRITIONAL VALUE IN DRY BEANS THROUGH PLANT BREEDING AND EDUCATION

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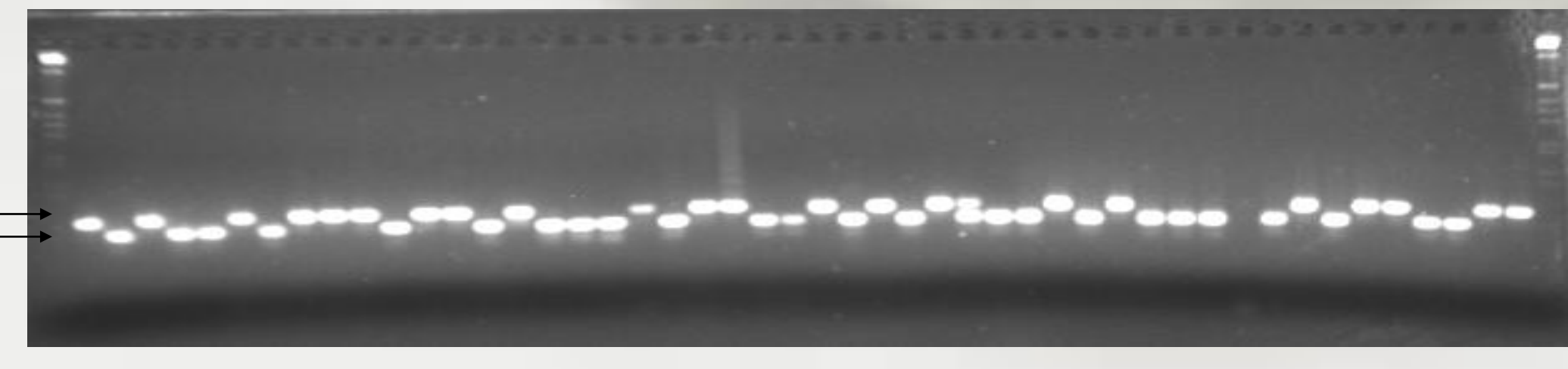
**Project Summary:** The Bean Coordinated Agricultural Project (BeanCAP) is a multi-state, interdisciplinary effort funded by USDA-NIFA and covering three integrated areas: research, education, and extension. Given the nutritional attributes of bean consumption, the project focuses in the genetic identification and characterization of 25 nutritional traits of interest in both dry and snap beans, and the generation of market-class-specific SNP markers using an association mapping approach. The marker platform will be also used to identify loci associated with drought tolerance. In addition, low cost markers that leverage the information from the high throughput marker screening are being developed. The marker and phenotypic data generated by this project will be organized along with all available genetic maps, markers, and loci data into a database that is fully operable with other legume databases. Preliminary results have allowed obtaining the first set of 5000 SNP markers and the nutritional profile of 200 snap bean genotypes. In the area of education, the group is currently working on increasing awareness of career opportunities in bean breeding and early recruitment of students using hands-on experiences and social networking. Most plant breeders agree that they became breeders because they were somehow exposed to it. Even undergraduate students in agriculture start hearing about plant breeding in their junior and senior years, when most of them have already chosen a different area to develop their careers. Direct hands-on learning activities are aimed to spark interest in high school and undergraduate students. A total of 22 students across four states have been part of the program during the first two years. Additional activities include presentations in high schools and student meetings, career fairs, and other activities. The extension component is working in conjunction with the education efforts in the development of printed and audiovisual media that will be available in the BeanCAP public website. Available material includes brochures, posters, videos and animations, and modules, some of which are currently used in schools. Topics include both plant breeding and the nutritional value of beans. Preliminary accomplishments and current challenges in all three areas of the project are presented.

## Objective 1: Market-class specific markers



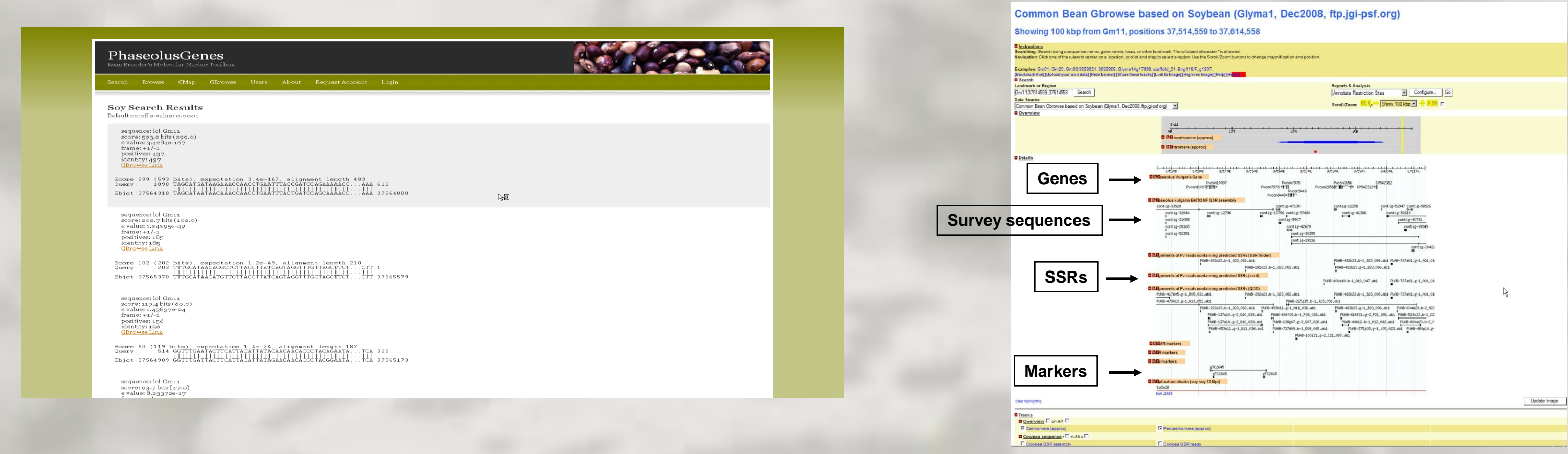
Market class	Chromosome											Total
	Pv 1	Pv 2	Pv 3	Pv 4	Pv 5	Pv 6	Pv 7	Pv 8	Pv 9	Pv 10	Pv 11	
Navy	16	6	2	2	11	4	5	2	0	2	8	58
Pinto	12	30	0	2	7	6	6	0	10	3	20	96
Black	1	1	2	0	4	2	0	1	0	0	1	12
Great northern	20	30	6	1	3	5	3	2	2	4	11	87
Kidney/snap	11	1	2	38	5	0	1	7	5	10	15	95

## Medium- and low-throughput markers



## Objective 3: Database Development

### PhaseolusGenes Features



<http://phaseolusgenes.bioinformatics.ucdavis.edu/>

## Objective 4: Early Plant Breeding Training Program

Direct hands-on learning activities are aimed to get high school students and undergraduate students that would encourage them to consider plant breeding as a career option. Internships during the summer months and the academic semester are exposing the students to all the daily activities commonly undertaken in any breeding program. Using a holistic approach, researchers are exposing students to both conventional breeding techniques as well as new approaches using genomic tools. These educational activities are simultaneously conducted at four universities. Additional activities include presentations in high schools and student meetings, career fairs, as well as the development of printed and audiovisual media that will be available in the BeanCAP public website.



## 100% recruitment success would be unrealistic, but...

- There is a lot of indirect impact:
- We are informing the general public and creating awareness.
  - Young students will become voters in the future and therefore:
    - They will be better informed.
    - Some of them will be leaders making final decisions.
  - Will create more consciousness about the food chain.



## Objective 2: Nutritional Phenotypic Analysis

### Elemental Analysis of Field Grown Snap Beans

Nutrient Class	BeanCAP samples					USDA market samples		
	Range	Fold	Mean	SD	n	Mean	SD	n
<b>Macro (mg/g DW)</b>								
Ca	3.68 – 8.20	2.2 x	5.71	0.99	104	3.82	0.14	153
K	13.34 – 27.47	2.1 x	18.43	2.50	104	21.80	0.46	154
Mg	2.10 – 3.77	1.8 x	2.86	0.31	104	2.58	0.07	151
P	2.15 – 4.96	2.3 x	3.39	0.59	104	3.93	0.08	140
S	1.17 – 2.33	2.0 x	1.68	0.24	104	NA		
<b>Micro (µg/g DW)</b>								
Cu	2.29 – 7.18	3.1 x	4.90	0.94	104	7.13	0.41	161
Fe	48.81 – 148.23	3.0 x	79.85	15.44	104	106.40	7.95	155
Mn	13.66 – 57.95	4.2 x	28.08	7.39	104	22.31	0.83	150
Na	1.81 – 36.76	20.3 x	11.81	7.13	104	619.83	18.18	154
Ni	2.58 – 6.37	2.5 x	4.48	0.74	103	NA		
Se	0.18 – 0.78	4.3 x	0.46	0.15	94	0.60	0.00	1
Zn	21.30 – 42.14	2.0 x	30.39	4.10	104	24.79	2.17	152

## Objective 5: Educational Multimedia Development

### Nutrition Game

**Now Serving: Beans!**

**What's In a Bean?**

- Fiber
- Antioxidants
- Complex Carbohydrates
- Protein
- Vitamins
- Minerals

**A Healthy Choice**

- Heart Health:** Studies show a diet rich in beans helps reduce the risk of heart disease.
- Cancer-reducing Agents:** Beans are rich in antioxidants which have been shown to reduce the risk of certain cancers.
- Pregnancy and Healthy Babies:** Beans provide an excellent source of fiber, protein, vitamins and minerals that reduces the risk of neural tube defects in infants.
- Food Allergies and Intolerances:** Beans provide a good source of fiber, protein, vitamins and minerals that may otherwise be lacking in the diet.

### Nutrition Animation

