

**Promoting Sustainable Beekeeping Practices  
Through Local Production of Nucs (nucleus colonies) and  
Local Queen Honeybees**

**2011 Final Report  
SARE Grant FS08-223**

*Dedicated to my new (beekeeping) brothers and sisters*

**&**

*In gratitude to our friends- the wiser, more experienced beekeepers  
who gave generously of their time and helped us on our way*



# Promoting Sustainable Beekeeping Practices through local production of nucs (nucleus colonies) and local queen honeybees

## Sustainable Agriculture Research and Education (SARE)

### 2011 Final Report

## 1. General Information

**Project Title:** Promoting Sustainable Beekeeping Practices through local production of nucs (nucleus colonies) and local queen honeybees

**Project Number:** FS08-223

**Total Amount Budgeted:** \$14,736

**Producer Organization:** Prince William Regional Beekeepers Association (PWRBA), c/o Karla Eisen, 6311 Catharpin Road, Gainesville, VA 20155. (703) 753-9023 or (703) 314-8530, email: [karla6311@hotmail.com](mailto:karla6311@hotmail.com) and [PWRBeekeepers@gmail.com](mailto:PWRBeekeepers@gmail.com); website: <http://www.PWRBeekeepers.com>

## 2. Summary

The Prince William Regional Beekeepers Association (PWRBA) producer SARE project compared hives started from packaged bees to hives started from nucleus colonies (nucs) positively demonstrating higher survival for nuc started hives than package started hives, with survival differences more pronounced in the second year. Education and training resulted in adopting more sustainable beekeeping practices. These centered on utilizing existing colonies to produce sufficient nucs to (1) replace dead hives, (2) increase apiaries, and (3) provide starter hives for new beekeepers and association members instead of relying on commercially produced packaged bees from outside the region. The number of nucs made available to association members in lieu of packaged bees increased dramatically over the course of the project. Queen rearing was successfully initiated.

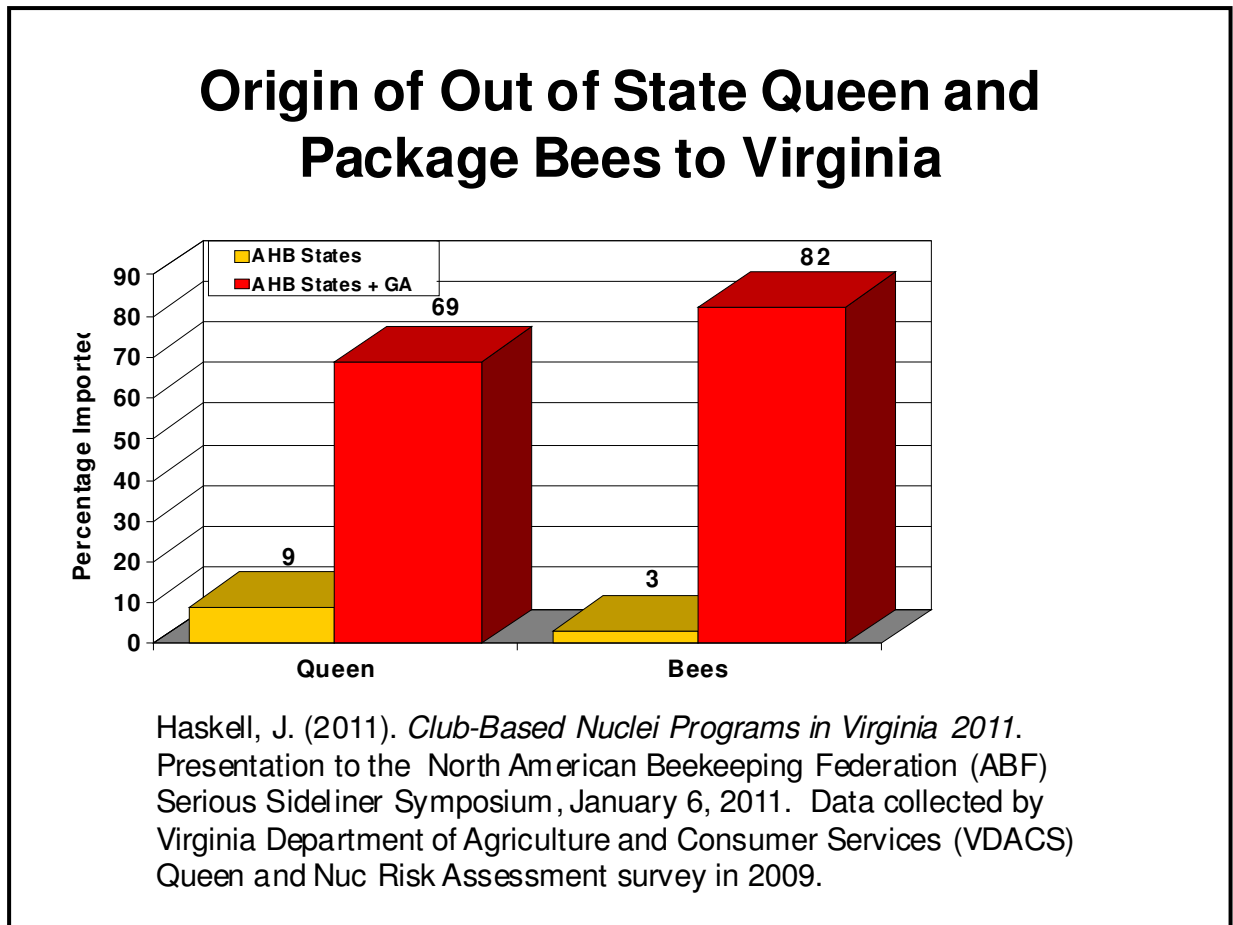
## 3. Introduction

The sustainability of current beekeeping practices is severely compromised. Honeybees are crucial to successful agriculture and environmental health, and the overall decline of honeybee health has become front-page news for much of the past several years. The Apiary Inspectors of America estimate that the recent phenomenon of colony collapse disorder (CCD) is responsible for the loss of over 25% of all hives nationwide in 2008-2009. In researching CCD

scientists have discovered that honeybees carry many pathogens and viruses effecting their overall health and survivability. In 2006 Senate Joint Resolution Number 38 requested that the Virginia Department of Agriculture and Consumer Services (VDACS) study the plight of beekeepers and identify possible remedies problems. This resulted in Virginia Senate Document 20, *The Study of the Plight of Virginia Beekeepers*, which discussed the major problems faced by the beekeeping industry and identified initiatives in four areas that would help stimulate recovery of the beekeeping industry. The report indicated that honeybee hives (colonies) were reduced by more than 50% in the past 20 years and wild/feral honeybees had nearly disappeared. The annual mortality rate of colonies in Virginia had more than tripled to approximately 30% in large part due to the parasitic varroa mite, poor nutrition and other associated diseases. The report identified increasing beekeeping costs due to replacing dead hives and unproductive queens with greater frequency combined with increased cost of packaged bees, queens, specialized equipment, medications, and transportation.

At the time this SARE grant was submitted (2007), most Virginia beekeepers relied and still do rely on commercially produced “packaged bees” and queen bees to restart their hives or establish new colonies. In Northern Virginia, thousands of packages of bees are brought in every year from suppliers outside of the region, primarily Georgia, Texas or California. These bees are thought to be less suitable for surviving the local climate. The production of packaged bees is stressful. They are “shaken” out of existing hives and put together with commercially produced queen bees in a box and transported. These packages are also increasingly at risk of being affected by Africanized honey bee genetics (AHB) and small hive beetle (SHB) which are spreading in the production areas. The potential for the accidental introduction of AHB into Virginia would not only affect bees, but could potentially pose a significant danger to domesticated animals and the general public. In 2009 VDACS collected data from beekeepers on the source of bees purchased or made in home apiaries. At the November 2010 Virginia State Beekeepers Association (VSBA) meeting, this data was presented showing that bees imported from States with identified AHB made up less than 10% of all queens and less than 3% of all packaged bees imported. However in 2010 with the identification of AHB in Georgia occurring that same year, the percentage of bees imported from States with AHB jumped to over 80% of packed bees and nearly 70% of queens. Figure 1, *Out of State Queen and Package Bees to Virginia*, below presents these findings.

Figure 1: Out of State Queen and Package Bees to Virginia



The VDACS Study of the Plight of Virginia Beekeepers stressed that the decline of honeybee health and survivability in Virginia directly affects not only the sustainability of beekeeping and honey production at all levels (hobbyist, sideliner, and commercial beekeeper) but potentially could affect the local production of specific agriculture crops that rely on honeybees for pollination (such as cucumbers, melons, apples, etc.). Many in the beekeeping community see the sustainability of beekeeping contingent upon new ways of operating. We defined sustainable beekeeping practices to include the following:

- Increase hives by making nucleus colonies (nucs) out of existing hives instead of importing local packages from out of area
- Use locally reared queen bees from existing well performing honeybee stock Utilize an Integrated Pest Management (IMP) approach with organically based methods as much as possible (i.e., powdered sugar, thymol, formic acid, screened bottom boards, etc.)
- Provide ongoing education, training and mentoring to new and existing beekeepers

- Provide outreach and educate to the community about honeybees and beekeeping.

The ability to produce a consistent supply of local honeybees is paramount to sustainability efforts. A local supply of honeybees directly contributes to sustainable beekeeping as it increases the potential to utilize bees that are better adapted for local conditions and therefore have increased chance of survival. The 2006 Virginia study recommended local queen rearing programs be developed throughout the State in order to produce a pest and disease resistant line of honeybees that is highly productive, sustainable and free of the aggressive behavior of AHB. The two year progress report on the recommendations of this study (Fell, 2009) reported that there is a sustainable market for queen and honey bee production, including nucleus hives. For the past several years, individuals in Virginia and other parts of the country have focused on strengthening the local supply of honeybees through producing nucleus colonies (nucs) made from existing local hives. This reduces dependence on packaged bees brought in from non regional sources.

There is a growing consensus that hives started from a nuc will have a greater potential to develop into a strong sustainable colony. Nucs are made up of honeybees in all stages of development and contain food (honey), pollen, a laying queen that has been accepted by the colony and worker, nurse, and field bees. They are generally made by taking frames of bees, uncapped and emerging brood, honey, and pollen out of existing hives and introducing a new queen bee. Essentially the nuc when successfully made is a “mini hive” with an already established organization that allows for rapid expansion. Nucs can be used to replace dead out hives, increase apiaries, and/or as an emergency backup supply of bees, brood, and/or queen for an existing apiary. Nucs have advantages over packaged bees. The colony started from a package immediately experiences a decline in population after it is installed and it will take a minimum of three weeks for new brood to be born to start replacing those bees. It can take up to 6 weeks for a package to develop into the same size as a 5 frame nuc. In addition, packaged bees are made with unrelated commercially produced queens which can lead to more queen rejection and supercedures<sup>1</sup> (queen replacement) further delaying the growth of the colony. Thus, even though most Spring nucleus colonies are commonly not available until six weeks after packaged bees are available, they can essentially be of the same size and strength and in many cases, stronger.

Promoting creating local supplies of honeybees among beekeepers and studying how to rear queen bees as a group we expected to dramatically shift the odds of honeybee survival in our favor. We proposed to learn how to raise our own bees and queens and reduce dependence on packaged bees from afar addressing the SARE producer grant focus areas of increasing the sustainability of existing farming practices and adopting agricultural techniques that make use of on-farm natural cycles. The project was designed to demonstrate more sustainable methods of starting new and/or replacing dead colonies using natural on-farm resources in existing apiaries

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<sup>1</sup> Supercedure is the process by which a queen bee is replaced by a new queen—a process that takes several weeks to complete. Supercedure may be initiated due to age of a queen, disease or a failing queen. Queen failure may also be a result of insufficient mating.

and support the viability of local beekeeping operations. Bees, nucs, and queens made locally help to eliminate need to spend money to replace bees and are a resource that can be sold offering a source of on-farm income.

Making nucs and queen rearing are not new or our original ideas; rather they had become somewhat of a “lost art”. Our success in this project can, in part, be explained by the words widely attributed to Sir Isaac Newton, “*If I have seen further than others, it is because I have stood on the shoulders of giants.*” Our plans were built on techniques long pioneered by beekeepers before us and we were the beneficiaries of instruction, mentoring and support of our, experienced beekeeper collaborators.

## **4. Objectives/Performance Targets**

Our objectives were conceptualized to address a solution to the weakened state of honeybee health, increasing beehive losses, the potential for Africanized bees to enter Virginia, and the overall threat to the sustainability of beekeeping by raising our own bees and queens and reducing dependence on packaged bees from afar. The objectives as outlined in the proposal were as follows:

- 1) Increase the knowledge and skill of local beekeepers in producing nucleus colonies (nucs) from existing hives and to test the viability of hives made from locally produced nucs to those made from packaged bees
- 2) Engage local beekeepers in the study of queen rearing and initiate local queen rearing efforts.
- 3) Promote sustainable beekeeping practices overall by emphasizing integrated pest management (IPM) and organic beekeeping practices throughout all of our educational and outreach efforts.

The overall goal of the SARE project was to teach and promote sustainable beekeeping practices that utilize the existing hives of our association to produce sufficient nucs to replace dead hives, and increase our apiaries. Our long term goal was to be able to provide starter nucs to new beekeepers and association members instead of relying totally only on commercially produced packaged bees from outside the local region. A secondary goal of the project was to initiate local queen rearing efforts with a long term goal of a successful backyard production of local queen bees within our association. The end result would be to produce sufficient queens for our members to make future nucs and requeen existing hives.

## 5. Materials and Methods

Due to the timing of the notification of SARE awards (March of 2008), and the difficulty of securing the necessary supplies and materials this late into the beekeeping year, the project was designed to start with a planning and education year (2008). During this time the primary activities were participant recruitment, education and training on nuc production and queen rearing, and designing data collection. We also initiated a small pilot project and made overwintered nucs in this first project year. This was followed by our full implementation year (2009) during which the primary activity was to make the hives from nucs and hives started from packages and collect data. Education and training continued in the second year. We received a no cost extension and continued our education, training and outreach activities through 2010 and early 2011 as well as conducted data analysis. All sites were the individual apiaries of our participants and classroom facilities of a local church.

We will discuss the design and methods of each aspect of our project in the following sub sections:

- Pilot Project
- Main Project Activity: Making Nucs and Comparing Nucs to Packages
- Added Sub Task: Overwintering Nucs
- Queen Rearing
- Educational Programs

### **5.1 Pilot Project**

It is hard to believe that we embarked upon this effort with a group of people who had never made a nucleus colony (nuc). In the Spring of 2008 we implemented a small pilot project as a “shakedown hike” to explore the challenges of producing viable Spring nucs, determine if beekeepers would be willing to wait to receive nucs as packages are often ready several weeks before nucleus hives, and to see if these hives started from nucs would develop into full hives as we anticipated. Two of our association members made two nucs each using locally reared queens from VP Queen Bees and provided these nucs to new beekeeping students. The nucs were successful and grew into full hives, despite not being made until early June.

### **5.2 Main Project Activity: Comparing Nucs to Packages**

We proposed to examine the viability or survival of hives started from packaged bees to hives started from local nucs. SARE participants were split into one of three groups depending on the *source of the queen* they would use in their nuc. The research sites were the individual apiaries of the participants. We realized that queen rearing is a detailed and delicate process with a high failure rate in the initial years, therefore we did not anticipate being able to produce

sufficient locally reared queens in the time frame of this project. Instead we purchased all of the queens used in the nucs. The groups included:

- A. *Group A* nucs started in mid April with commercially produced non-local queens
- B. *Group B* nucs started with locally produced queens from VP Queen Bees<sup>2</sup>,
- C. *Group C* nucs purchased nucs with a locally reared queen that was overwintered in a hive, and this queen, along with the accompanying brood frames and honey were pulled from overwintered hives to create a nuc. Group C was designed to include beekeepers that experienced hive loss or had hives too weak to produce nucs but still wanted to participate in the project.

Each beekeeper who agreed to participate in the project signed an agreement form and received what we referred to as one “hive starter set” consisting of the woodenware needed to build one nuc box, including frames, one queen bee to use in the nuc and one package of bees (including queens). Group C did not receive a separate queen, but instead received an entire nuc of bees with queen. SARE participants were responsible for purchasing the rest of the materials needed to build out the nucs and packages into full hives, supplemental feed, treatments, and committed to collect and record data on the hive assessment form at several points in time for each hive started. Participants received a small financial honorarium for their efforts and time commitment. A total of 22 beekeepers agreed to participate.

A table describing the implementation plan of the main activity of the project is provided next followed by Figure 2, *SARE Grant Roadmap Timeline*, a graphic outlining the timeline. The hive assessment data collection efforts are discussed in the outcomes section of this report, and examples of the forms are provided in the appendix.

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<sup>2</sup> VP Queen Bees, a Maryland based business, was also the recipient of a Northeast SARE grant, FNE08-631, to compare mite-tolerant queen lines with a normal line to see if two tests (selection assays) indicate mite tolerance in potential breeding stock. They can be contacted via their website at: <http://www.vpqueenbees.com>



**Prince William Regional Beekeepers (PWRBA) Sustainable Agriculture Research and Education (SARE) Grant  
Nuc Production Implementation Plan**

*Goal: 1) Increase knowledge and skill in producing nucleus colonies (nucs) from existing hives and 2) to test the viability of hives made from locally produced nucs to those made from packaged bees imported from the South*

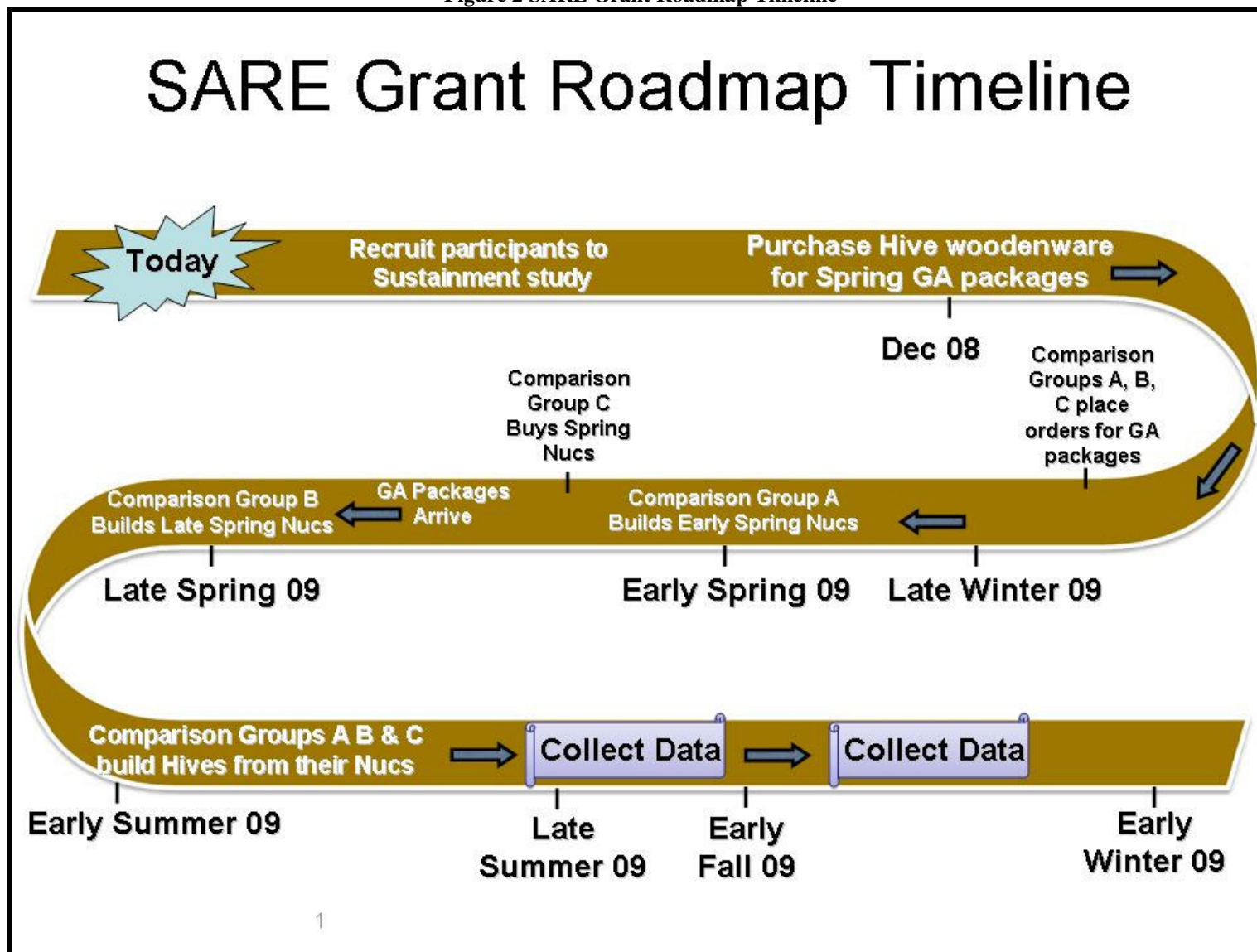
SARE Experimental Group	Method Used	Materials Needed	
		YOU PROVIDE...	SARE PROVIDES...
Comparison A	Make <b>Early Spring (April, 2009)</b> Nuc/Split and  Compare to Hive started from package ( <i>package will arrive Early Spring/April</i> )	<input checked="" type="checkbox"/> Bees from your current hives (or local beekeeper) to go into your nucs* <input checked="" type="checkbox"/> Hive bodies, Hive Tops, Bottom Boards, etc. for 2 FULL HIVES (one is future home for nuc, and the other is for your package <input checked="" type="checkbox"/> Data worksheets during process	<input checked="" type="checkbox"/> NUC BOX, 5 Replacement Frames, and Foundation (VA Bee Supply) <input checked="" type="checkbox"/> QUEEN for the NUC/SPLIT, ( <b>Imported from South</b> ) <b>April, 2009</b> <input checked="" type="checkbox"/> 1 box of packaged bees, with queen ( <b>Imported from South</b> ) <b>April, 2009</b> <input checked="" type="checkbox"/> Honorarium
Comparison B	Make <b>Late Spring (Mid May, 2009)</b> Nuc/Split and  Compare to Hive started from package ( <i>package will arrive Early Spring/April</i> )	<input checked="" type="checkbox"/> Bees from your current hives (or local beekeeper) to go into your nucs* <input checked="" type="checkbox"/> Hive bodies, Hive Tops, Bottom Boards, etc. for 2 FULL HIVES (one is future home for nuc, and the other is for your package <input checked="" type="checkbox"/> Data worksheets during process	<input checked="" type="checkbox"/> NUC BOX, 5 Replacement Frames, and Foundation (VA Bee Supply) <input checked="" type="checkbox"/> QUEEN for the NUC/SPLIT, ( <b>raised locally, VP Queens</b> ) <b>mid May, 2009</b> <input checked="" type="checkbox"/> 1 box of packaged bees, with queen ( <b>Imported from South</b> ) <b>April, 2009</b> <input checked="" type="checkbox"/> Honorarium
Comparison C*	BUY Live Nuc Late Spring ( <b>Mid May, 2009</b> ) (do not make your own nuc) and  Compare to Hive started from package ( <i>package will arrive Early Spring/April</i> )	<input checked="" type="checkbox"/> Finished (Live) Nucs purchased from a 3 <sup>rd</sup> party supplier (\$30 paid by you) ( <b>purchased locally with locally reared overwintered Queens</b> ) <b>late April, 2009</b>	
		<input checked="" type="checkbox"/> Hive bodies, Hive Tops, Bottom Boards, etc. for 2 FULL HIVES (one is future home for nuc, and the other is for your package <input checked="" type="checkbox"/> Data worksheets data during process	<input checked="" type="checkbox"/> 1 box of packaged bees, with queen ( <b>Imported from South</b> ) <b>April, 2009</b> <input checked="" type="checkbox"/> Honorarium

\*This is a chance to expand your beekeeping knowledge, confidence, and sustainability by making nucleus hives/splits from your own apiary

\*\* Group Comparison C will have a cost of approx. \$30 to supplement the additional price of live nucs

\*\*\* A, B, and C groups agree to collect data at 5-10 points in time and will receive financial honorarium

Figure 2 SARE Grant Roadmap Timeline



### **5.3 Added Sub Task: Overwintered Nucs**

Very early in the project, we became aware of “overwintered nucs” based on a presentation at the Virginia State Beekeepers Association meeting in April of 2009 by Michael Palmer of French Hill Apiaries, St. Albans, Vermont.<sup>3</sup> We later discovered that these methods had also been recently adopted by one of our collaborators; the Virginia-based Massanutten Mountain Apiaries (Pat and Jim Haskell) as well as by a newly formed organization, the Loudoun Sustainable Bee Project.<sup>4</sup> Overwintered nucs are a cornerstone of a sustainable apiary plan. They are made in the summer and managed as nucs over the winter. Ideally, due to the timing, locally made queens are available and used in the nucs. If these nucs survive the winter the queens are commonly referred to as “proven” and provide a local queen resource significantly earlier than local queens can be produced. Local queens are typically not viable until mid to late May and overwintered nucs are generally ready to use in this area by early to mid March. The overwintered nucs can then be used as the foundation for a new production colony with a queen who has already proven she can survive local winter conditions.

With the ongoing consultation of Mr. Palmer, a small sub group of five SARE participants produced overwintered nucs in 2008 and again in 2010 in addition to participating in the main SARE activity. For most of us, these were the very first nucs we ever made. Most of the nucs were made with locally produced queens, primarily from VP Queen Bees, and in the second year we were able to use a few queens produced by our own “Catharpin Queens” queen rearing efforts. There were several goals of this added sub task:

- 1) to learn how to successfully overwinter nucs with local queens to have locally reared queens the following Spring far earlier in the season than when we could produce our own queens
- 2) to provide a source for quality nucs to replace dead outs and expand our own apiaries
- 3) to provide a source for quality nucs for new beekeepers and club members to help reduce reliance on packaged bees.

We explored a variety of methods to make up overwintered nucs including individual nuc boxes, double nuc boxes, divided hive bodies, queen castles, polystyrene nuc boxes, etc. We shared information among our association on the various different set ups, shared our experiences making and managing these nucs, and actively participated in on line forums to learn from others around the country exploring similar methods.

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<sup>3</sup> Overwintered nucs are discussed in the published works of Michael Palmer and Larry Connor. See bibliography for citations.

<sup>4</sup> Information on the Loudoun Sustainable Beekeeping program can be found here: <http://www.sustainablebees.org/index.htm>

A table describing the implementation of the added sub task of overwintered nuc is provided below.

<b>Prince William Regional Beekeepers (PWRBA) Sustainable Agriculture Research and Education (SARE) Grant Added Sub Task: Overwintered Nucs</b>		
<b>SARE Group</b>	<b>Over Wintered Nucs 2008/2009</b>	<b>Over Winter Nucs 2009/2010</b>
<b>Goal</b>	Successfully over winter nucs 2008 and provide nucs for new beekeepers and/or bee club members in Spring 2009	Successfully over winter nucs 2009 and provide nucs for new beekeepers or bee club members in Spring 2010
<b>Equipment</b>	A variety of methods including single nuc boxes of 4 or 5 frames, double nuc boxes of 8-10 frames, polystyrene nuc boxes, divided hive bodies, modified “queen castles”, nucs placed on top of existing hives, nucs on special shared bottom boards, etc.	
<b>Queen Source</b>	Locally produced queens from VP Queen Bees	Locally produced queens from VP Queen Bees and SARE grant “Catharpin Queen” project

## **5.4 Queen Rearing**

All colonies, nucs included, need a queen bee, thus we proposed to study queen rearing with the long term goal of producing local queens for our association members. We were confident that local nuc production could be successfully implemented by our association; however we realized that queen rearing is a detailed and delicate process with a very high failure rate in the initial years, therefore we did not anticipate having sufficient locally reared queens in the time frame of this grant and instead planned to purchase half of the needed queens from a local queen producer who has a demonstrated commitment to sustainable beekeeping practices and half from a non-local queen producer. Queen rearing requires a good understanding of honeybee biology and the lifecycle of the honeybee, thus all queen rearing activities also served to enhance the knowledge and understanding of beekeeping among participants as well as emphasize integrated pest management to keep the process as natural as possible.

Three training classes in queen rearing were conducted starting in the first year of the SARE project (2008) and repeated in 2009 and 2010. The first two classes were led by the Virginia State Apiarist Mr. Keith Tignor of the Virginia Department of Agriculture and

Consumer Services (VDACS) and Dr. Fell, Professor of Entomology and Apiculture Extension Specialist Virginia Polytechnic University and State University, Blacksburg, VA. The first class also included local queen breeder Adam Finkelstein of VP Queen Bees. The first two classes consisted of four hours of classroom instruction, followed by 4 hours of field sessions in which queen production and replacement practices were demonstrated. The third class was a condensed classroom only version led by one of our association members and fellow SARE participant who had started the successful queen rearing operation in the prior year.

A small subgroup of SARE participants were provided with specialized equipment to initiate queen production with the goal of providing queens for their own use and for sale to other beekeepers within the association. The queen rearing program was dubbed, “*Catharpin Queens*” based on the location of the mating yards. The program started early in the summer of 2009 which is considered somewhat late in relation to the optimal queen rearing season in Virginia, especially for beginners. The program used the grafting method from hives with positive queen attributes and raised queen cells in small styrofoam mating nucs. Queens were provided for a nominal fee to several association members for use in nucs and to requeen hives. In addition, SARE participants and association members were encouraged to let hives requeen naturally instead of replacing queens with commercially produced Southern queens which was a common practice previously. Individual backyard queen rearing was also encouraged which primarily focused on using swarm or supercedure cells that are naturally produced in the hives to raise a queen. Several SARE participants and association members have reported success with both methods. As an example, one SARE participant overwintered and sold three nucs with queens raised in this method.

## **5.5 Educational Programs**

We conducted several educational programs and held field days on nuc production, nuc management and queen rearing. All of the programs included discussion of integrated pest management techniques. The programs were led by a wide variety of people that ranged from SARE project director, regional beekeeping experts, EAS Master Beekeepers, the Virginia State Apiarist and University based professors. The majority of these programs were also open to all members of our beekeeping organization and several presentations were open to all beekeeping clubs in the region. All programs and classes were offered free of charge.

Our educational programs for the SARE project ended with two highlights at the very end of the grant period. We rented a large room and invited beekeepers from the entire region to these events. In March of 2011, we hosted Erin Forbes of Overland Apiaries, Portland, Maine who directed what we commonly referred to as our “*Sister SARE Project*” due to the similarities of goals. She presented preliminary results from her two SARE projects, comparing honeybee colony strength and survivability between nucleus and package started colonies (SARE grants FNE09-665 and FNE10-694). The final educational presentation on The Sustainable Apiary

occurred just after the end of the SARE grant period due to scheduling issues, represented the pinnacle of our efforts in approaching sustainable beekeeping and was presented by Michael Palmer of French Hill Apiaries, St. Albans, Vermont who also provided the initial guidance and consultation to our overwintered nuc efforts. A complete list of educational programs is displayed in the table below, Educational Programs and Field Days related to the SARE grant.

<b>Prince William Regional Beekeepers Association (PWRBA) Educational Programs and Field Days related to the SARE grant</b>		
<b>Date</b>	<b>Presentation</b>	<b>Presenter</b>
April 2011	The Sustainable Apiary: A Management Plan for Sustainability in the Apiary	Mike Palmer, French Hill Apiaries, St. Albans, Vermont
March 2011	A Comparison of Honey Bee Colony Strength and Survivability between Nucleus and Package Started Colonies & Practical Backyard Queen Rearing	Erin Forbes, Overland Apiary, Portland, Maine
February 2011	Nucs Nuts and Bolts	Pat and Jim Haskell, Massanutten Mt. Apiary, Northern VA Teaching Consortium
Oct. 2010	Nucology Expanded	Billy Davis, Loudoun Sustainable Bee Program
June 2010	Overwintered Nucs	Karla Eisen and John Strecker, PWRBA
May 2010	Queen Rearing Basics	Keith Fletcher, PWRBA
April 2010	Installing and Managing Nucs Field Day	John Strecker, PWRBA
March 2010	Overwintered Nuc Survival Assessment Field Day	Keith Fletcher, PWRBA
May 2009	Making Nucs- How To	Karla, John, and Keith, PWRBA
May 2009	Queen Rearing Class and Field Day	Keith Tignor (State Apiarist) and Dr. Rick Fell (Virginia Tech)
April 2009	Hive Assessment Field Day	Karla, John, Keith, PWRBA
April 2009	Transferring Overwintered Nucs into Full Hives field day	Keith Fletcher, PWRBA
March 2009	Making Nucs-How To	Karla, John, and Keith, PWRBA
September 2009	The Plight of Virginia Beekeepers Study and Virginia Sustainability Efforts	Keith Tignor- State Apiarist
September 2009	Nuc Management	John Fraser, Highland Honey
June 2008	Queen Rearing Class and Field Day	Keith Tignor (State Apiarist), Dr. Rick Fell (Virginia Tech), and Adam Finkelstein (VP Queen Bees)
May and Sept 2008	Introduction to the PWRBA SARE grant	Karla, Keith, John, PWRBA

## **6. Outcomes/Impacts**

We proposed only to measure outcomes of our main SARE activity, hives started by packaged bees as compared to hives started by nucleus hives. We later developed an overall evaluation form and collected data on the added sub task of making overwintered nucs. We posed the following questions as indicators of success:

- Will hives made from nucs develop into different, stronger, and/or more viable hives?
- Will we become more comfortable making and using nucs for spring management, increases and/or overwintering?
- Will we be able to provide nucs out of apiaries in increasing numbers for new beekeeping students in 2010 and beyond?
- Will we become more proficient rearing our own queens in the long term?

### **6.1 Outcomes: Main Project Activity- Comparing Nucs to Packages**

Our approach to promoting sustainable beekeeping centered on the idea that we would be able to use existing colonies within our association to produce sufficient nucleus colonies to supply both new beekeepers and association members with nucs and reduce reliance on packaged bees. For the main SARE experiment we compared two hives started from different sources (packages vs. nucs) and used three different queen sources for the nucs. To measure outcomes we modified a hive assessment form based on our review of several existing hive assessment tools. The form was designed to assist beekeepers in conducting a thorough assessment of their hives at least one time per month on key indicators of hive health and productivity. The hive assessment included items such as assessing laying pattern of the queen, presence of disease, treatment, gentleness of the hive, management techniques such as reversing, feed, etc. It also asked participants to record weather patterns, time of day they were in the hive and floral and tree bloom in an effort to increase awareness of how weather patterns and floral sources influence hive health and activity. The hive assessment tool was transformed into an online survey with a separate individual survey form for each month for each hive type (i.e, hive started from a package and hive started from a nuc). We utilized the online subscription service of Survey Monkey to collect data. Data was collected from March 2009 through June of 2010. Data was downloaded and manually compiled in an excel spread sheet for analysis. A copy of the hive assessment form and a sample of the survey monkey online data collection form are provided in the appendix.

Quality data collection was the most challenging aspect of the project. Despite repeated requests for data and ongoing encouragement to individuals, participants varied widely in their ability to report data. Approximately two-thirds of the group reported data on regular monthly intervals, while others reported inconsistently and a few participants provided very minimal data. This resulted in limited data available across all participants at every time interval to assess outcomes on all measures. Data analysis was refocused on key variables such as queen replacement and supercedure and hive survival data was obtained from each participant.

Our participants were a mixed in their level of experience and time keeping bees with nearly half of the group with two or less years of experience as a beekeeper. The more experienced beekeepers were predominantly in Group A due to their desire to make nucs earlier in the season. Almost every participant used screened bottom boards in the hive set up and several used IPM techniques such as drone comb mite trapping and powdered sugar dusting. Several reported mites and a few treated for mites with one of the existing thymol based products. The table below shows participants as broken out by number of years of experience they had in our implementation year (2009) and the SARE group they were in.

<b>Prince William Regional Beekeepers (PWRBA) Sustainable Agriculture Research and Education (SARE) Grant Participants by Beekeeping Experience and SARE Group</b>				
<b>SARE GROUP</b>	<b>2 years beekeeping</b>	<b>3 years beekeeping</b>	<b>4 years beekeeping</b>	<b>5 or more years beekeeping</b>
A (total = 9)	2	3	1	3
B (total = 8)	7	0	0	1
C (total = 5)	2	2	1	0
Total = 22	11	5	2	4

### ***Package Started vs. Nuc Started Hive Survival Results***

Data analysis showed that nuc started hives were more likely to survive than packaged started hives. A total of 68% of package started hives survived the first winter whereas 83% of nuc started hives survived this first season. These results were further emphasized in the second year. Hives that survived the first year and then again through the 2010 season into 2011, consisted only of 40% of packaged hives, whereas 70% of nuc started hives survived into the second year. All hives experienced queen replacements naturally via supercedure and manually by requeening. The locally produced queens used in Group B were dramatically less likely to supersede or need replacement compared to queens used in the other two groups. Locally produced queens used in Group B hives demonstrated only 1 supercedure and no requeening. In contrast, all but one of the queens used in Group A (commercially produced out of the area) were replaced with the majority superseded by the end of summer (5 out of 8), one was requeened due to poor performance, one survived, and one did not report data. Many of the nucs used in Group



C unfortunately showed signs of chalk brood almost immediately which influenced queen replacement. Of the six nuc started colonies in Group C, three were requeened as advised to manage the chalk brood and one queen was superseded. The package bee data was reported less consistently on this measure, in part because half of the packaged hives had unmarked queens which were harder to track. A minimum of 6 packaged hives superseded (3 of the superseded packages survived the first year) and 3 were requeened (2 of the requeened packages survived the first year). Only one of the package started hives showed laying workers after install. The table below provides data on package started and nuc started hive survival.

<b>Prince William Regional Beekeepers (PWRBA) Sustainable Agriculture Research and Education (SARE) Grant Package Started vs. Nuc Started Hive Survival Results 2009-2011</b>									
<b>Package Started Hive</b>					<b>Nuc Started Hive</b>				
Pkg. n = 22	Pkg Hive survival 09/10	Pkg Hive loss 2009/10	Pkg Hive survival 10/11	Pkg Hive loss 10/11	Nuc n = 23	Nuc Hive survival 09/10	Nuc Hive loss 09/10	Nuc Hive survival 10/11	Nuc Hive loss 10/11
<b>A</b>	8	1	4	4	<b>A</b>	7	1	6	1
<b>B</b>	4	4	2	2	<b>B</b>	7	2	6	1
<b>C</b>	3	2	0	3	<b>C</b>	5	1	2	2
<b>Total</b>	<b>15</b>	<b>7</b>	<b>6</b>	<b>9</b>	<b>Total</b>	<b>19</b>	<b>4</b>	<b>14</b>	<b>4</b>
	<b>68%</b>		<b>40%</b>			<b>83%</b>		<b>74%</b>	
<i>There were 22 participants, however a few participants collected data on more than 1 nuc, and one nuc was removed from the analysis, thus the different sample sizes in each group.</i>									

### **Limitations of the Data**

There are limitations of the data that should be considered when interpreting our results. The participant groups contained beekeepers with various levels of years of experience and skill in beekeeping. We were not able to measure or factor in if failure or success was had any relation to prior experience or know how. The differences in individual management styles and use of IPM methods were also not factored in. There were also differences in hive set up, primarily in the size of the frames in the brood chamber (deep or medium), starting with new foundation or drawn comb (the majority of participants installed packaged bees on at least some drawn comb), and type of feeder used. The amount of food supplied was also not consistently applied, nor was the use of treatment and/or medications. The location of colonies and available forage although similar, was still different for each participant. Lastly, weather and the available pollen and nectar were other variables that could have affected results. The 2009 beekeeping started with a long wet and rainy Spring that was challenging for bees and early queen rearing. The rain

reduced forage days and washed out nectar. It also made queens mating more challenging. However, the wet Spring was a factor in producing a rare “Fall flow” in many areas providing more nectar than usual for bees during the late summer and early Fall which is traditionally a time of significant nectar dearth in this area.

## **6.2 Outcomes for Added Task: Overwintered Nucs**

We were most surprised at our success in the added task of overwintered nuc production. As stated earlier, this method was not part of our original design and for most of the participants this was actually the first nuc we produced, made even before the main SARE grant experiment nucs. We were however so convinced of its ultimate benefit and integral part of our goal of sustainability that we forged ahead. The table below presents our results. A small group of five nuc producers had an 80% success in the first year and 75% success in the second year with this method. We more than tripled the number of nucs made from 10 in the first year to 34 in the second year, and nearly quadrupled the number of nucs made available to new beekeepers from 4 in the first year to 19 in the second year. The majority of these nucs were made with locally reared queens. We continue our efforts to make overwintered nucs and to train more people in these methods.

<b>Prince William Regional Beekeepers (PWRBA) Sustainable Agriculture Research and Education (SARE) Grant Added Task: Overwintered Nucs</b>		
<b>Year</b>	<b>2008/2009</b>	<b>2009/2010</b>
<b>Goal</b>	Successfully overwinter nucs in 2008 and provide nucs for new beekeepers and/or bee club members in Spring 2009	Successfully overwinter nucs in 2009 and provide nucs for new beekeepers and/or bee club members in Spring 2010
<b>Number of participants</b>	5	5
<b>Nucs Produced</b>	10	34
<b>Nuc Survived</b>	8 (80% survival)	26 (75% survival)
<b>Nucs made available to others</b>	4	19

### **6.3 Queen Rearing Outcomes**

Even with its late start towards the end of the nectar flow, the queen rearing program had very positive outcomes. As a result of the class, several individuals (including a few beekeepers from other associations in the region) raised queens on their own using various techniques and either used them in their own apiary or made them available to other beekeepers. The SARE queen rearing program resulted in a few grafting sessions and approximately 15 queens produced. The queens were made available to association members for a nominal fee and not only filled the need for a queen, but had the added benefit of providing support and encouragement to members to pursue their own queen rearing and to witness for themselves the positive outcomes of using locally produced queens in their hives. For example, one of the recipients of these queens, a first year beekeeper, started to make nucs to sell to other beekeepers the following year. Plans to pursue and enhance the “formal” queen rearing program were unfortunately halted in 2010 due to the retirement and subsequent relocation of the task leader, however mentoring is provided one on one to individuals raising queens and many continue to do so. Association based Queen rearing efforts are being revised and several members will participate in an intensive weekend training this Spring (2011) with Dr. Larry Connor.

### **6.4 Educational Outcomes**

We held over 16 educational programs, field days and classes as listed in the methods section. These were attended by a range of 25- 50 people, and the last two workshops were attended by over 100 people. We did not conduct an evaluation of any of these sessions individually with the exception of the full day queen rearing class and field day. This queen rearing class evaluation was given to the non SARE participants who attended the class as SARE participants completed a separate evaluation of the entire project. Results of the evaluation will be included in the next section on overall accomplishments.

## **7. Accomplishments**

*“Never doubt that a small group of thoughtful, committed, citizens can change the world. Indeed, it is the only thing that ever has.” Margaret Mead*

The quantitative data of hive survival, success with overwintered nucs, and queen rearing provides only a fraction of what believe was truly accomplished in this project. In combination with our extensive educational programs we believe that by participating in the SARE project we now have within our association better educated beekeepers with the following attributes:

- 1) ability to make informed assessments of hive health, queen viability, hive dynamics, honey production, etc.
- 2) ability to use integrated pest management techniques
- 3) ability to produce spring and overwintered nucs
- 4) better understanding of honey bee biology and skills in basic queen rearing.

The SARE project has focused our entire association on the goal of sustainability and less reliance on packaged bees. Every meeting, educational lecture and workshop since the SARE grant award has contributed to our goal of more sustainable beekeeping practices. The environment we created invited other local beekeeping associations to participate in our activities and interact with our members forming a more dynamic, engaged, collegial and educated beekeeping community in the region that would not have developed if acting individually.

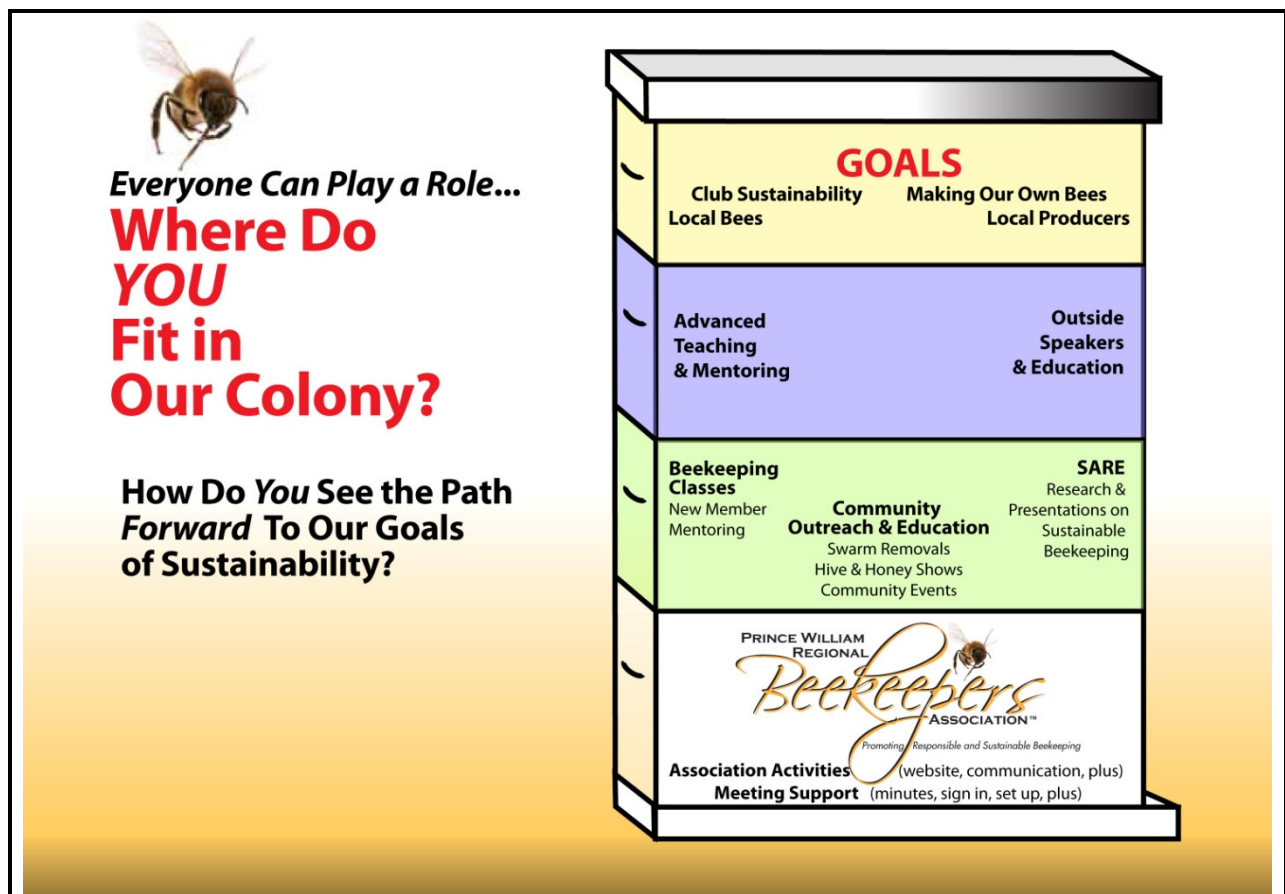
Not only did we educate existing members in sustainable methods (*a participant survey at the beginning of the SARE grant showed that over 50% had little to no skill in making a nuc*) we partnered with parallel efforts of the Northern Virginia Teaching Cooperative to integrate more education on sustainable beekeeping into the Introduction to Practical Beekeeping class conducted in several counties each winter educating hundreds of new beekeepers. In the past, classes focused on packaged bees and only provided packaged bees to new students. The classes now include more emphasis on sustainable beekeeping practices including a module on installing nucs. This new focus helped support the transition within our own association to encourage new beekeepers to start with one nuc and one package of bees instead of the traditional two packages of bees. For the past three years, we have provided at least one nuc for new beekeepers which allows them to start their beekeeping experience exposed to working with nucs. We have changed from a total reliance on packaged bees to providing over 50% of our new beekeepers with nucs to start hives. In addition, we developed a new module for the introductory class entitled “*Ways to Get Bees*” (attached in appendix) to teach the various ways to get bees, the pros and cons of starting with packages or nucleus colonies and to provide further support for starting new beekeepers with at least one nuc.

Feedback received from a project evaluation form completed by many participants and included the few beekeepers that were not part of SARE but took the queen rearing classes was overwhelmingly positive. For example, one participant described the queen rearing class as “*one of the biggest highlights of my beekeeping career.*” Another stated “*Four years ago, I didn’t know the first thing about beekeeping. Now I’ve got a state bee inspector who wants [to buy] my bees.*” Many described learning new skills such as queen rearing, IPM methods, as well as a tremendous increase in their knowledge of honey bee biology, beekeeping in general, and a better ability to conduct hive inspections, assess and manage colonies. For example, one participant said, “*I learned to appreciate what the program was teaching me, which are methods to keep “in-house” bees healthy and productive and to avoid using unregulated genetics/sources.*” Several described increased confidence, especially related to requeening hives by both installing new queens and raising their own queens. Everyone described a greater commitment to seeking more local source of bees when possible and many have a greater

understanding genetics and its role in queen rearing. Several discussed how their beekeeping practices are more sustainable since they are able to make nucs and rear queens.

Record keeping was described as both a challenge and a positive. Some described being “forced” to conduct hive inspections monthly helped them stay focused on managing colonies. For example one stated, “I learned that if I kept notes I made more observations. The more observations I made, the better I monitored my hives proactively.” Others found monthly hive inspections challenging. A few mentioned that their lack of record keeping and documentation prevented them from being able to track key indicators such as new queen development and mite loads.

The following graphic is a visual display of our organizational structure and displays how sustainable beekeeping is integrated as a core goal of our association.



## 8. Potential Contributions

The long term benefits to expect from this project are healthier colonies of bees headed by more locally produced queens and/or queens with hygienic attributes, more bees and queens produced locally and made available to beekeepers, and increased sustainability of our beekeeping association and beekeeping within the region. The continued loss of colonies has created a demand for bees which the packaged bee industry is struggling to meet. There is significantly more demand for bees from local sources. There are increasing possibilities to derive on-farm income from raising and selling bees and a market who desires this not only exists but is growing. Even a small income derived from selling bees can positively impact the financial sustainability of beekeeping operations.

## 9. Publications/Outreach

Outreach was an integral part of every aspect of our SARE project and included outreach to existing and new beekeepers as well as the public. The majority of our association activities and programs included some reference to the SARE project and/or sustainable beekeeping practices. The SARE logo was used prominently in our presentations, display materials at public events and as part of our association brochure. The above section on accomplishment, discusses the environment SARE created within our association to invite members of other local beekeeping associations to participate in our activities and interact with our members forming a more dynamic, engaged, collegial and educated beekeeping community pursuing sustainable beekeeping practices in the region. Several of our SARE participants spent time mentoring new beekeepers and existing beekeepers who were not SARE participants in sustainable methods of backyard queen rearing and nuc making to include overwintered nucs.

A list of our educational programs and classes was presented in prior sections in this report. Many of the programs, including the entire queen rearing class were filmed and made available either by hard copy DVDs or through our new link to our association website ([www.vimeo.com](http://www.vimeo.com)) which is capable of hosting videos for a yearly subscription fee. We generously provided hard copy DVDs of the Queen Rearing Class and the sentinel 2009 presentation on overwintered nucs to several beekeepers in Virginia and Maryland to help promote adoption of overwintered nucs and backyard queen rearing. Almost all of the power point slides used in the various presentations were made available either through our redesigned website or via email by request. The hive assessment form and nuc guidelines we produced are available on our website at <http://www.pwrbeekeepers.com>. We were approached by several beekeepers around the country and shared our methods and accomplishments in telephone and email conversations. We participated in on line forums such as [www.beesource.com](http://www.beesource.com) to share methods and results of our overwintering nuc activities. The final SARE report will be available on the SARE website and on our own website by request. We presented on Sustainable Beekeeping and our SARE project to the Prince William Conservation Alliance in the Spring of

2010 (handouts attached in appendix) and were interviewed by two newspapers which included mention of the SARE project. We will present the results of our study to the Beekeepers of Northern Virginia (BANV), a large local beekeeping association as well as to our own club in May of 2011. Selected results of our efforts were incorporated into part of a presentation, Club Nuc Programs in Virginia, to the American Bee Federation (ABF) presented by Jim Haskell in January, 2011. We are considering submitting a proposal to present to the Eastern Apicultural Society (EAS) annual meeting whose 2012 theme will be Sustainable Beekeeping.

## 10. Future recommendations

- 1) Develop guidelines and protocols for establishing an ongoing nuc program within a beekeeping association including matching up producers and buyers that can be used by other associations.
- 2) Explore the feasibility and different outcomes and approaches to adopt more local sources of bees as researched in our “sister” SARE project FNE10-694 and FNE09-665 to requeen packaged bees with locally reared queens as soon as queens are available (mid-late May) as a “compromise” option between making overwintered nucs and using packaged bees.
- 3) Conduct a similar investigation into overwintered nucs comparing success utilizing different methods to assess the pros and cons of different techniques.

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## **APPENDIX**

Hive Assessment Tool  
Sample Online Data Collection Form  
SARE participant evaluation  
SARE queen class evaluation  
SARE Press Release  
SARE Implementation Year Kickoff Meeting Handout  
SARE Welcome letter (Word doc)  
SARE Participant Agreement  
Overview of SARE Implementation Plan and Simplified Nuc Making Handout  
PWRBA Nuc 2011 guidelines  
PWRBA Association Sustainability Visual  
Ways to Get Bees Handout  
Sustainable Beekeeping for Non Beekeepers Handout

## **APPENDIX B- Photos**