Canadian Northern Economic Development Agency

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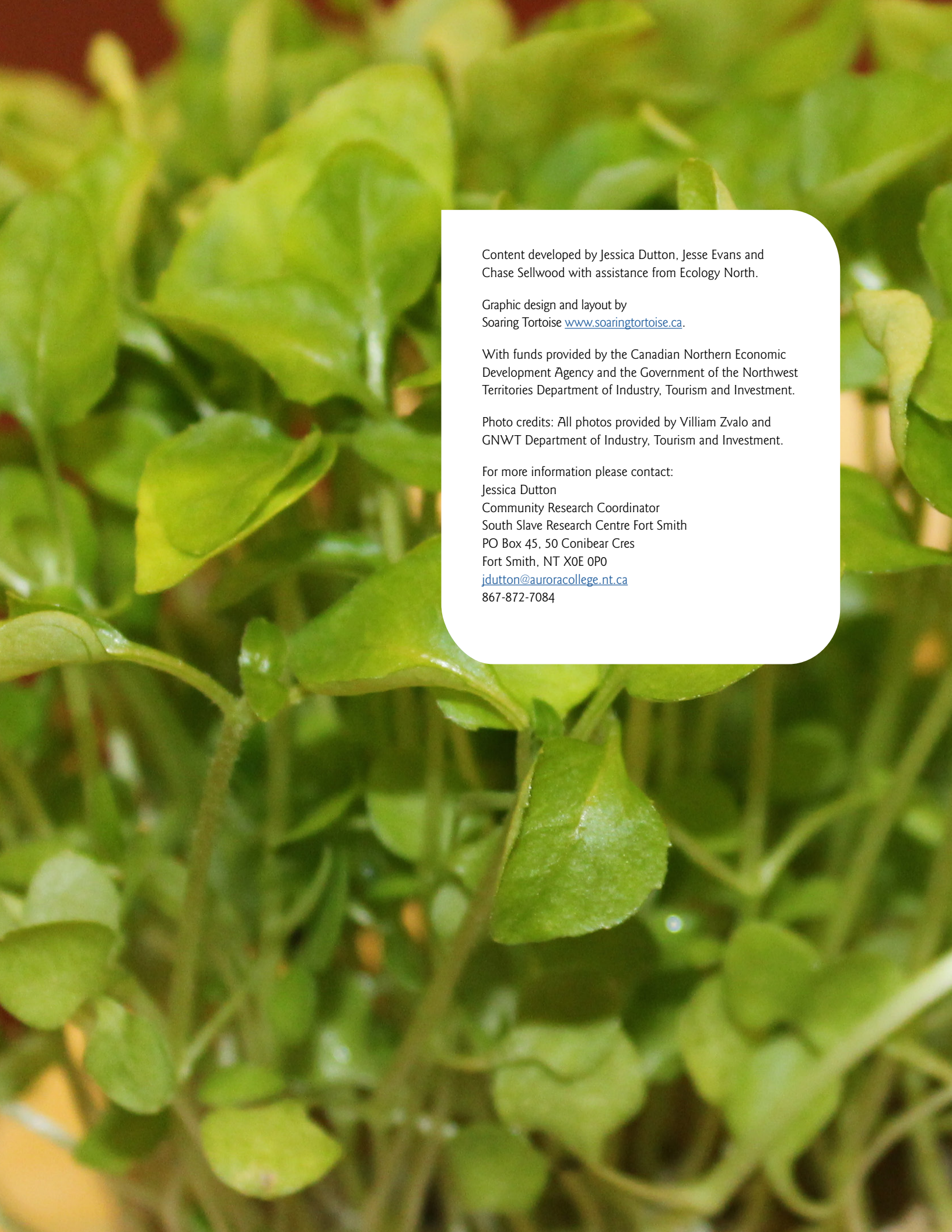
Government of Northwest Territories Gouvernement des Territoires du Nord-Ouest

NWT CanGrow

Greenhouse Feasibility Guide



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Introduction

The main goal of this document is to ensure that growers have the tools to evaluate the feasibility of a commercial greenhouse and gather the necessary information before investing the immense time and resources that commercial growing requires. By learning basic community readiness, crop planning and accounting strategies, growers are establishing the basis for a strong, well-planned commercial greenhouse.

The Aurora Research Institute developed the NWT CanGrow Greenhouse Feasibility Study to find out whether it is feasible to operate a commercial greenhouse in the Northwest Territories (NWT). NWT communities are interested in improving food security, increasing access to fresh and healthy produce, encouraging positive dietary choices and creating economic opportunities in local food production. Community growing initiatives have expanded across the north in recent years and a community of growers has emerged to support the budding NWT agricultural shift.

This guide identifies the questions that need to be considered before launching a commercial greenhouse enterprise. The guide will assist growers in assessing community readiness by determining the local demand for produce, the price of local produce and whether there is local interest in the option of buying produce from a greenhouse. Next, we consider the design of the greenhouse - what materials will it use and how will these account for the local environment? What will be grown and how will crop decisions determine the size of greenhouse required? How will it be heated, irrigated and powered and how much energy will these systems require? Last, we consider the bottom line: after estimating all costs and revenues, can the proposed greenhouse be sustainable? In the end, users should have a clear sense of how their design and operating decisions impact the overall feasibility of their proposed greenhouse.

Who might use this guide?

This guide is aimed at intermediate and expert growers who have the skills necessary to start growing on a large, commercial scale. We do not recommend attempting large-scale commercial growing without significant experience. Users of this guide may have a plan for the greenhouse they want, or may be planning to use a greenhouse that already exists. Alternatively, users may be in the research and planning stages; this guide can help assess the feasibility of the options they are considering.

This guide should not be used as an introduction to greenhouse growing. For readers who may be interested in learning about greenhouse growing, we recommend consulting with your local GNWT ITI office, the Northern Farm Training Institute, or an experienced grower in your community.

How do I use this guide?

The guide is designed to be used from start to finish, starting with assessing community readiness, then considering greenhouse design considerations and ending with accounting for costs and revenues. Some of the strategies used to assess feasibility are challenging - crop planning and estimating the needs of a commercial operation can be quite a bit of work. Still, we recommend putting in the effort to develop an accurate estimate of your operations now, to improve your chances of success in the future.

The guide is designed to break down challenging planning decisions into manageable steps in order to walk users through the process with less frustration. After working through the guide, a user may find that their greenhouse is more expensive or less productive than they had hoped - at this point, users can go back through the document and adjust inputs throughout the document to improve the feasibility of their plan.

Part 1

Community Readiness

This community readiness assessment is designed to help you get a sense of the market for greenhouse products in your community. The goal is to gain information about your potential customers, find out which crops are in demand, and determine where you will be selling your product.

Investigating the Market

Estimating Demand

Once the customer base is identified, it's important to find out what these customers will be interested in purchasing - this is the demand. Many factors can influence demand: what do customers like to eat? What can they afford? Can you provide something they like, but cannot access from other suppliers? Is your product higher quality than other similar produce available?

Use the following survey to collect information about demand - you can make copies, send it in an email, or ask the questions over the phone. There are also a number of free online survey-making tools that you can use to get your questions online - then you can send out the link to potential customers, post it on social media accounts, or send it out to your contacts list.

Sample Size

Often, when administering surveys, one is concerned with the size of the "sample" - the pool of people who are responding to your survey. The more responses you get, the more accurate the information will be, however, if you are working with a high volume of responses (eg. in the hundreds,) you will also need a more sophisticated method for sorting and organizing responses. With fewer responses, you may be able to get a quick sense of the trends in responses, but you will be less certain that those few peoples' opinions reflect the opinions of your whole customer base.

For larger communities, it may be sufficient to aim for a sample size that is 2% of your community's population. For example, in a community of 3000 it may be enough to sample 60 people. In smaller communities, 2% of the population will not be enough and you may have to aim for closer to 10-20%. Gather information from many different people and include all the groups checked off above, under *Who are your customers*. The more information you can gather, the better you can plan how much you will need to grow to meet your customers' demands.

Who are your customers?

In order to find out if there is a market for greenhouse produce, first consider: Who are your customers?

- ☐ Friends
- ☐ Family
- ☐ Neighbours
- ☐ Caterers
- ☐ Restaurants
- ☐ Grocery stores
- ☐ Farmers markets
- ☐ Gardeners
- ☐ Territorial
- ☐ Institutions
- ☐ Other:

Markets and Sales Models

Having a diverse customer base is a great way to ensure the stability of your commercial greenhouse. Direct sales to individual customers is a popular business model that allows the grower to sell their produce for the highest return. However, if you can manage the volume, consider including restaurants, grocery stores, and territorial institutions, as they make large, consistent orders. Registering with the GNWT's *Business Incentive Program* will make you eligible to supply produce to jails, treatment centres, hospitals and special care homes.

Customer Demand Survey

1 When you are shopping for fresh fruits and vegetables, how important are the following things:

	Very Important	Somewhat Important	Neutral	Somewhat Unimportant	Not Important
Freshness					
Low price					
Grown locally					
Organic					
Variety					

2 How do you feel about the fruits and vegetables that are available in the community right now?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The fruits and vegetables in my community are always very fresh.					
Very fresh fruits and vegetables are not usually available for me to buy.					
The fruits and vegetables I buy are only sometimes fresh.					
I would be willing to pay a little more for very fresh produce.					
I cannot afford to spend extra for the freshest fruits and vegetables.					
I will buy fruits and vegetables wherever they are the cheapest, even if the quality is lower.					
I think fruits and vegetables should be grown locally.					
I think fruits and vegetables should be grown organically					
I would support a local business that sells fresh fruits and vegetables.					

3 When you are shopping for fresh fruits and vegetables, how important are the following things:

	Always	Often	Seldom	Never
Beans				
Beets				
Broccoli				
Cabbage				
Cauliflower				
Cucumbers				
Carrots				
Eggplant				
Garlic				
Kale				
Kohlrabi				
Leek				
Lettuce				
Mixed Greens				
Onions				
Peas				
Peppers (bell)				
Peppers (hot)				
Potatoes				
Radishes				
Spinach				
Swiss Chard				
Tomatoes				
Turnips				
Zucchini				
Strawberries				
Fresh Herbs				

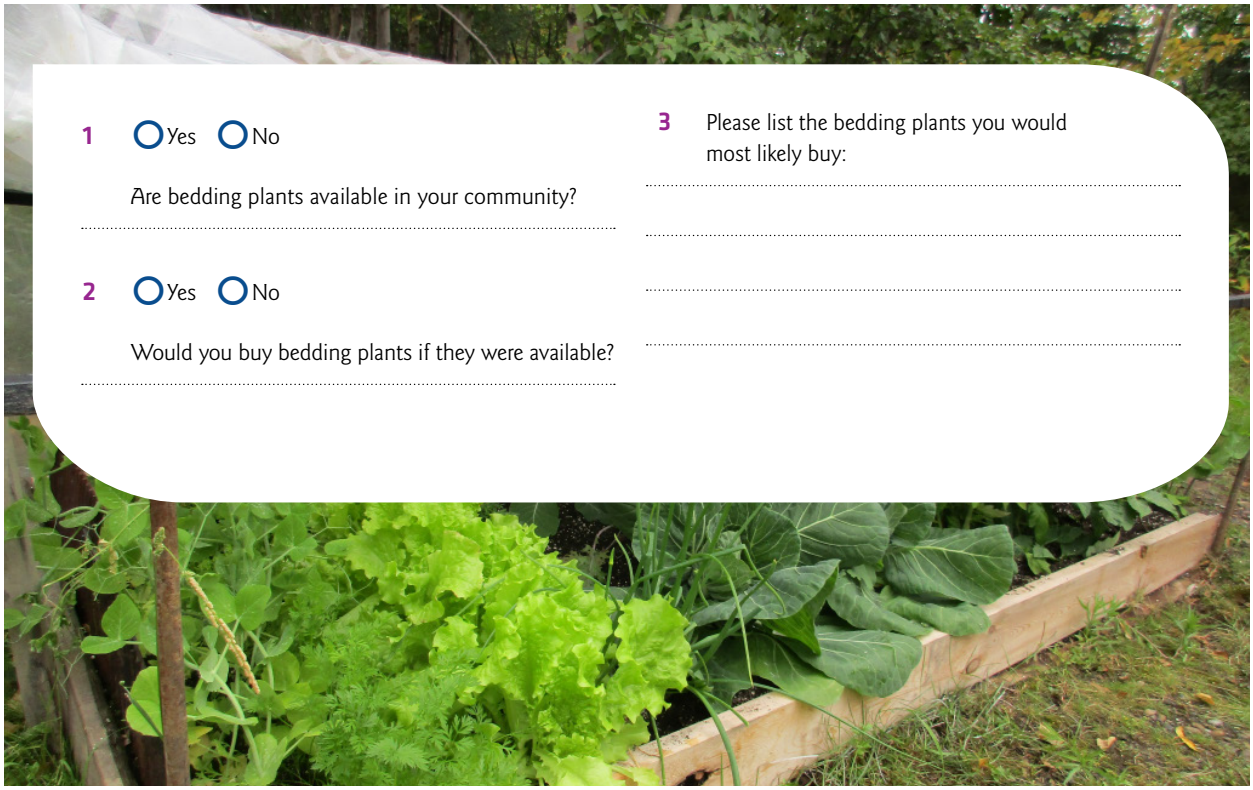
4 What are the top five vegetables you buy every week?

1	
2	
3	
4	
5	

5 What are your weekly quantities of the above produce? Example: three heads of green lettuce and one of romaine

1	
2	
3	
4	
5	

Bedding Plants Survey



1 ○ Yes ○ No

Are bedding plants available in your community?

2 ○ Yes ○ No

Would you buy bedding plants if they were available?

3 Please list the bedding plants you would most likely buy:

4 How likely are you to buy the following bedding plants if they were available?

	Very Likely	Somewhat Likely	Somewhat Unlikely	Not Likely
Annual flowers for pots and planters				
Annual flowers for a flower bed				
Perennial flowers				
Vegetables for a home garden				
Vegetables for a home greenhouse				
Herbs				
Berry bushes				
Shrubs for landscaping				
Trees for landscaping				

High Volume Customers Interview Questions

Speak to local businesses about their current produce consumption, and find out their interest in buying local. Below are some questions that can help guide your conversations.
They are divided into targeted audiences:

Territorial Institution

What percentage of your monthly food budget goes to produce?

Where do you buy fresh foods currently?

What produce do you consistently order in large quantities?

Do you have a set list of produce you order every week?

Could you supply me with your weekly produce needs?
Are you satisfied with the freshness of your produce?

Would you be interested in planning your menu around food crops that are in-season and change weekly/biweekly?

How do you feel about giving the institution to a local, commercial greenhouse?

Restaurant

What percentage of your monthly food budget goes to produce?

What produce do you consistently order in large quantities?

Would you be interested in planning your menu around food crops that are in-season and change weekly/biweekly?

Could you supply me with your weekly produce needs?

Would you be interested in sitting down with your local grower at the beginning of the season to request specific crops you would purchase a consistent volume of throughout the growing season?

Would you like to start incorporating organic and/or heirloom produce to your menu?

Are you interested in incorporating new crop varieties into your dishes as they become available?

How do you feel about giving your business to a local, commercial greenhouse?

Non-Greenhouse Crops

Potatoes, onions and carrots are a significant portion of the produce order for some NWT restaurants. You may want to consider expanding your operation to include non-greenhouse crops as a way to gain a larger share of your customer base's produce needs.

Grocery Store

How important is the freshness of fruits and vegetables you purchase? Are you satisfied with the freshness currently available?

How many shipments of produce does your store get in per week?

What is the volume of produce coming in per shipment? (eg, how many pallets?)

Could you supply me with your weekly produce needs?

What is your percentage of food wastage upon the arrival of your produce?

What is the average shelf life of your produce?

What produce do you sell the most?

How important is it to you to supply organic produce?

How do you feel about giving your business to a local, commercial greenhouse?

The Fruit Man

The Fruit Man is a businessman who has been delivering produce from BC to Inuvik and surrounding communities for the past three decades. His produce, sold out of his truck, is considered to be some the freshest available in the region. His success suggests that supplying nearby communities could be a viable business model.

Pricing Produce

Aim to grow your crops at the current market price during your first year. Find the local price for each of the crops you intend to sell in your greenhouse. Plot the prices in the chart below, and then set your prices. For each crop, you need to consider how it is sold: is it a head of lettuce or a pound of tomatoes? This is your *unit type*.

Example

Crop type	Unit type	Current market price	Your price
Tomatoes	Pound	$3.67/lb	$3.50/lb
Cucumber	Fruit	$4.29 ea	$4
Spinach	Gram	$7.39/284g	$7/300gr
Mixed Greens	Pound	n/a	Not carried locally

Produce Pricing

Crop type	Unit type	Current market price	Your price

Analyzing the Data

The information collected through the surveys can help to determine if there is enough interest among community members to support the introduction of a new commercial greenhouse in the community. Use the tables below to establish how many respondents agreed and disagreed with the survey statements.

Positive Statements

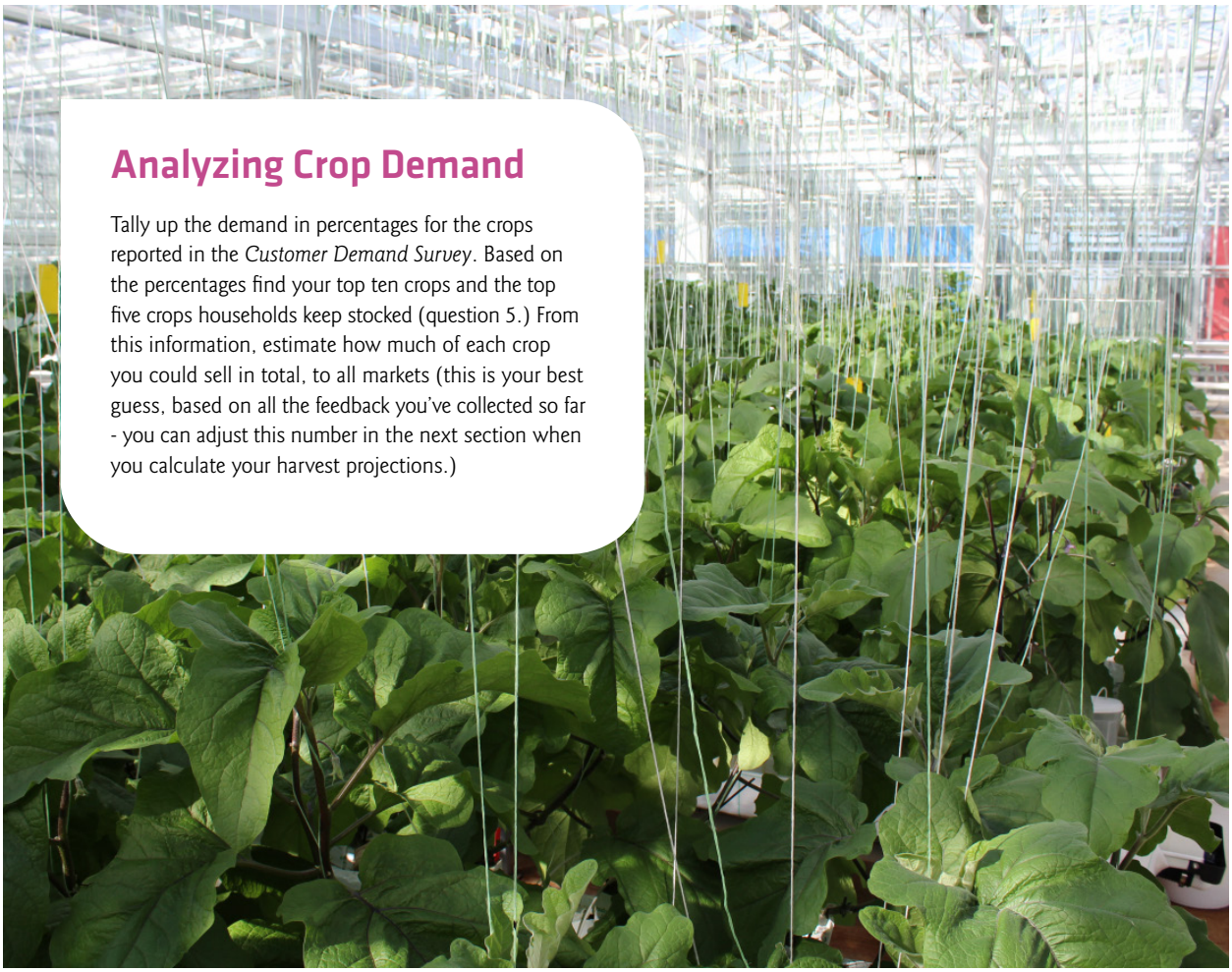
	Agree or Strongly Agree	Neutral	Disagree or Strongly Disagree
The fruits and vegetables in my community are always very fresh.			
I would be willing to pay a little more for very fresh produce.			
I will buy fruits and vegetables wherever they are the cheapest, even if the quality is lower.			
I think fruits and vegetables should be grown locally.			
I think fruits and vegetables should be grown organically			
I would support a local business that sells fresh fruits and vegetables.			

Have more than 50% of your respondents agreed or strongly agreed to these positive statements? This is a good indication that there is local support for a commercial greenhouse.

Negative Statements

	Agree or Strongly Agree	Neutral	Disagree or Strongly Disagree
Very fresh fruits and vegetables are not usually available for me to buy.			
The fruits and vegetables I buy are only sometimes fresh.			
I cannot afford to spend extra for the freshest fruits and vegetables.			
I will buy fruits and vegetables wherever they are the cheapest, even if the quality is lower.			

Have more than 50% of your respondents disagreed or strongly disagreed to these negative statements? This is a good indication that there is local support for a commercial greenhouse.



Analyzing Crop Demand

Tally up the demand in percentages for the crops reported in the *Customer Demand Survey*. Based on the percentages find your top ten crops and the top five crops households keep stocked (question 5.) From this information, estimate how much of each crop you could sell in total, to all markets (this is your best guess, based on all the feedback you've collected so far - you can adjust this number in the next section when you calculate your harvest projections.)

Example - Analyzing Demand

Always & Often	Seldom & never	Top ten crop?	Top five crop?	Estimate demand in units	
93%	7%	Yes			Lettuce
95%	5%	Yes	Yes		Mixed Greens
94%	6%	Yes	Yes		Onions
80%	20%				Peas
92%	8%	Yes			Peppers (bell)

Analyzing Demand

	Always & Often	Seldom & never	Top ten crop?	Top five crop?	Estimate demand in units
Beans					
Beets					
Broccoli					
Cabbage					
Cauliflower					
Cucumbers					
Carrots					
Eggplant					
Garlic					
Kale					
Kohlrabi					
Leek					
Lettuce					
Mixed Greens					
Onions					
Peas					
Peppers (bell)					
Peppers (hot)					
Potatoes					
Radishes					
Spinach					
Swiss Chard					
Tomatoes					
Turnips					
Zucchini					
Strawberries					
Fresh Herbs					

Analyzing Bedding Plant Demand

Bedding plants can be an important source of revenue for commercial greenhouses. Use the table below to establish how many respondents expressed interest in each type of bedding plant.

If more than 50% of your participants indicated they would be likely or somewhat likely to buy bedding plants, it may be worthwhile to explore how bedding plants can supplement your proposed operation.

	Likely & Somewhat likely	Somewhat Unlikely & Not Likely	Never
Annual flowers for pots and planters			
Annual flowers for a flower bed			
Perennial flowers			
Vegetables for a home garden			
Vegetables for a home greenhouse			
Herbs			
Berry bushes			
Shrubs for landscaping			
Trees for landscaping			

Analyzing high volume customer demand

Some organizations may be able to supply you with standing orders or give you a close estimate of their weekly and/or monthly needs. Use the table below to plot the reported demand for high volume customers you've approached.

Example – High Volume Customers

Institution/Location	Produce Type	Weekly Units	Monthly Units
School lunch program	Lettuce/head	1	4
	Tomatoes/lbs	1	4
	Bell Peppers/fruit	3	9
Grocery Store	Lettuce/head	15	60
	Romaine/head	10	40
	Tomatoes/lbs	15	60
	Cucumbers/per fruit	7	28
	Basil/bundle	3	9

High Volume Customers

Institution/Location	Produce Type	Weekly Units	Monthly Units

Analysis Questions

Ask yourself the following questions about the information you have gathered:

- Did at least 50% of the people I surveyed have positive responses to questions about demand for a local commercial greenhouse?
- Is there demand for fresh produce in my community? Is there enough demand to support a greenhouse?
- Can I grow the kinds of crops that the community wants? Do I want to?

If the answer to each of these questions is YES: Congratulations!! You can be reasonably certain that your community is ready for a commercial greenhouse.

If the answer to some of these questions is NO: there could still be demand for a commercial greenhouse, but it's important to have a clear sense of what exactly the community wants. It may be time to survey a larger group of people and start gathering more in-depth information.

Check your Success

Although [an unsuccessful feasibility study] may appear to be a failure, it's not. The real failure would have been if you had invested your own and others' money and then lost it due to barriers you failed to research in advance.

- David E Gumpert,
How to Really Create a Successful Business Plan

Part 2

Design Planning

The previous section of the feasibility assessment looked at local community factors that can help determine whether a commercial greenhouse is viable. This section will help you consider the feasibility implications of your design decisions.

Crop Planning

The community readiness surveys in the last section provide the first ideas about what you should be growing – you want to grow things that potential customers want to buy. The most in-demand crops in your community are also the most likely to contribute to a feasible greenhouse operation. The next step is to do some crop planning, which will help you make decisions about how you will design your greenhouse.

Crop planning is a multi-step process that usually begins with an estimate of your projected sales. This section will provide you with some crop planning examples and calculations that are relevant to greenhouse design decisions – this will allow you to explore the feasibility of your design. Once feasibility is established, it's important to put together a detailed crop plan before you embark on your project. Check out the Further Reading box below for some recommended guides and resources.

Units Per Week

Calculating your units per week will help you determine how much of each crop you will grow. The community readiness surveys in the previous section can give you an indication of which crops are in-demand – these are crops you will want to grow many units of, since you can expect to be selling many each week.

Estimate the number of units of each crop you will need for each week of the growing season for one market. That is, start out with a spreadsheet of only the crops you will be selling at the farmer's market, then estimate how many units you will sell each week. Then create a separate spreadsheet for crops that will be sold on-site at your greenhouse, crops you will sell to restaurants, or any other markets you plan to sell to.

Considering Your Market

Where will customers buy your crops? Considering your markets is important for estimating the number of units per week that you will need to grow.

You may choose to sell your bedding plants on-site at your greenhouse, take your highest yielding crops to a farmer's market, and sell only specific crops to restaurants and local grocery stores.

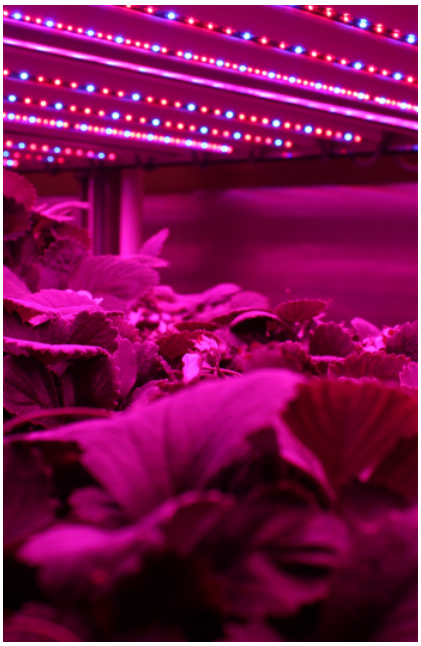
Each market is likely to require different units of each crop. Be sure to create a units per week spreadsheet for each different market you plan to sell to.

Selecting a Harvest Date

In the *Units Per Week Planning Chart*, you are asked to identify your harvest date. To create a reliable growing schedule, it is important to designate specific dates for planting and harvesting. Your harvest date should be the same day each week - maybe you want to harvest every Friday to be ready for the weekend farmer's market. Identifying your harvest dates upfront will make it much easier to plan your planting and transplanting later on.

Units Per Week Planning

1. Identify your market – you will need one chart per market
2. Identify the crops you plan to sell to that market
3. Identify the units you will use to sell each crop
4. Select a harvest date for each week of your growing season (add your dates in the month column on the left)
5. Estimate how many units of each crop you plan to sell in this market during that week.

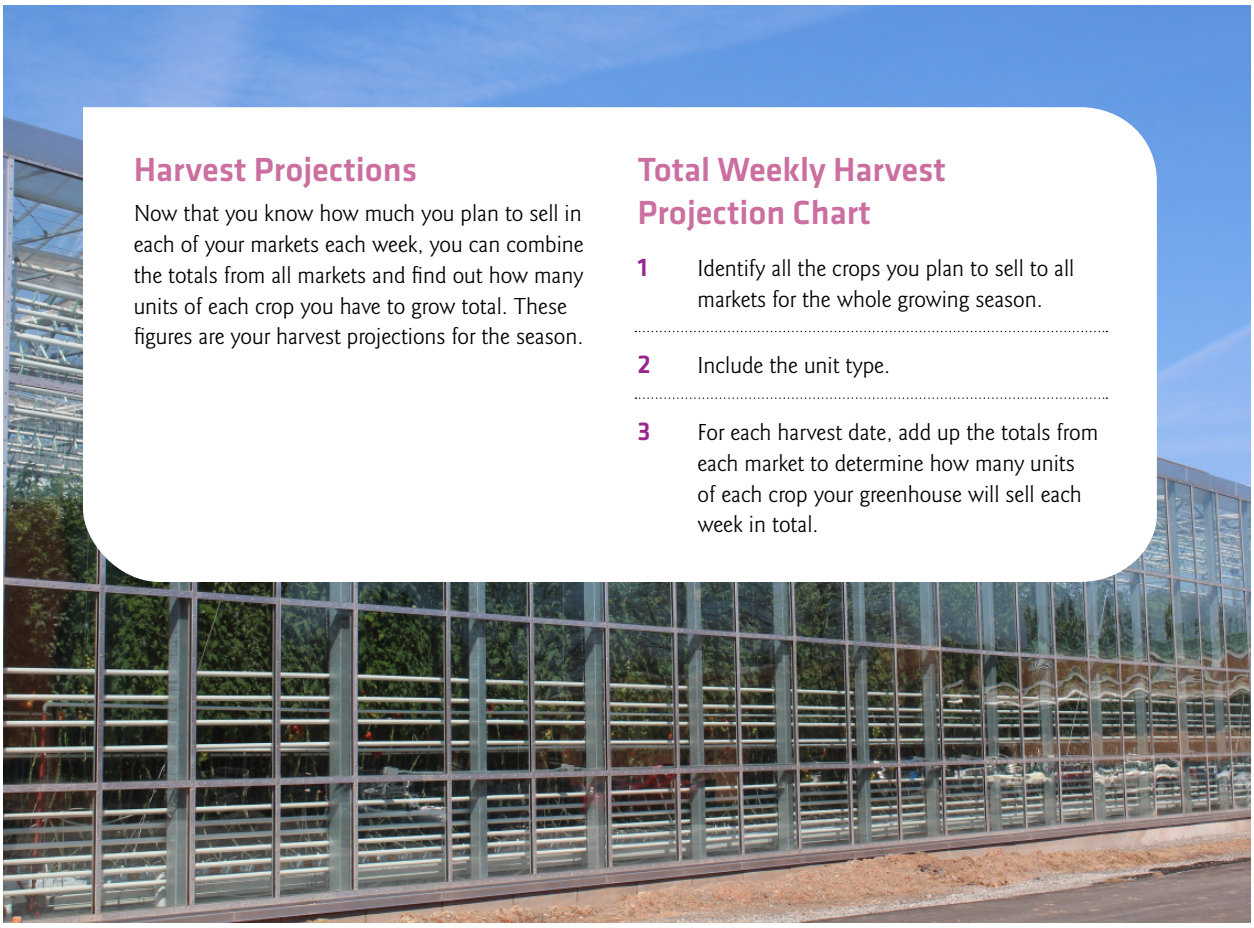


Example: Farmer's Market

Crop		Basil	Cucumbers	Lettuce	Tomatoes
Unit		bunch	fruit	head	pound (lb)
	June 24			25	
	July 2	15	25	25	
	July 9	15	25	25	
	July 16	15	25		30
	July 23	15	25		30
Total		60	100	75	60

Units Per Week Planning

Harvest Date		Crop						
		Unit						
MAY								
JUN								
JUL								
AUG								
SEPT								
OCT								
Total								



Harvest Projections

Now that you know how much you plan to sell in each of your markets each week, you can combine the totals from all markets and find out how many units of each crop you have to grow total. These figures are your harvest projections for the season.

Total Weekly Harvest Projection Chart

1. Identify all the crops you plan to sell to all markets for the whole growing season.
2. Include the unit type.
3. For each harvest date, add up the totals from each market to determine how many units of each crop your greenhouse will sell each week in total.

Example: Total Weekly Harvest Projections

Harvest Date		Crop	Cucumbers	Lettuce	Tomatoes
		Unit	fruit	head	pound (lb)
JUL	June 24			75	
	July 2			75	
	July 9			75	70
	July 16		65		70
	July 23		65		70
Total		200	195	225	280

Total Weekly Harvest Projections

Harvest Date		Crop						
		Unit						
MAY								
JUN								
JUL								
AUG								
SEPT								
OCT								
Total								

Space Requirements

Growing area is determined by the space you dedicate to various growing mediums such as seedling trays, rows and beds, pots, and vertical growing systems. By planning how you will use these spaces, you will be able to estimate the total amount of space your crops require each month. To have a feasible greenhouse operation, you will need to make the most efficient use of these various mediums to achieve the targets set out in your greenhouse schedule.

Growing Area

Now that you have established your units harvested, you can determine how much space each crop will require each month. *Growing area per harvest* is a useful measure of growing area. The formula to calculate it is:

$$\frac{\text{(Units Harvested/RPB)}}{\text{YPF}} = \text{Growing Area per harvest}$$

However, if you plan to use a hydroponic system your crop yield will likely increase. A conservative estimate for yield increase would be 20%. Add this amount to your YPF number for each crop. Additionally, your RPB for a vertical growing system will always be 1 row. Remember while an increased yield is advantageous, you will have to account for this with an increase in labour time.

Growing Area required (Monthly GA Req) is the total space needed for every harvest in the month. This is calculated by adding up the GA per harvest for each week. Use the *Growing Area Planning Chart* below to organize this information and record your calculations for each crop:

In the example, the greenhouse will need to make 28 feet of beds available for basil plants in the month of July. This information is critical for determining whether your greenhouse can accommodate the crop types and harvest volumes that you have proposed. Knowing how much space each crop requires in a given month allows you to strategize your plant spacing according to your greenhouse size, or determine the greenhouse size that could best accommodate the crops and volumes you hope to grow.

Finding the RPB and YPF of a Given Crop

Rows per bed (RPB) establishes how many rows of a given crop can fit into a bed.

Yield per foot (YPF) establishes how many plants grow in each foot of the growing space.

Each crop has an industry-standard RPB and YPF that can be found online or in published crop-planning literature. Keep this info handy for crop planning in future seasons.

Example: Growing Area - Basil

Harvest Date		Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
JULY	July 02	50 bundles	7	1 plant/ft	7ft	28ft
	July 09	50 bundles	7	1 plant/ft	7ft	
	July 16	50 bundles	7	1 plant/ft	7ft	
	July 23	50 bundles	7	1 plant/ft	7ft	

Growing Area

Crop: _____

Harvest Date		Units Harvested	RPB	YPF	GA Per Harvest	Monthly GA Req
MAY						
JUN						
JUL						
AUG						
SEPT						
OCT						
Total						

Space for Seedlings

Planning the space required for your seedling trays ensures you will be able to start enough plants earlier in the season to meet your harvest targets later. Now that you know the monthly growing area for each crop, you can find out the total number of seedling trays you will need for each crop in each month of the season. By calculating how many trays you need per week you will then be able to calculate the space you need to dedicate to the seedling growing area. The calculation for determining your total amount of trays is:

Total trays = (Monthly GA Req x RPB/IRS) = Total Trays
Tray size

To calculate the *Total ft2/wk* multiply the *Total Trays* number by the square foot dimension of your seedling tray. Be sure to round your total number of trays up to the nearest decimal point. This will make your numbers easier to work with and also account for any losses due to poor germination rates and loss due to transplanting.

Once you have your total number of trays, multiply it by the square foot dimension of the tray size (length x width) to get the total surface area. This number will go in the column Total ft2/wk. Use the Seed Tray Planning Chart below to organize this information and record your calculations for each crop:

Finding IRS For A Given Crop

In-row spacing is the measure of space between each row in a bed.

Each crop has an industry-standard IRS that can be found online or in published crop-planning literature. Keep this info handy for crop planning in future seasons.

Example: Trays Planted - Basil

Harvest Date	Monthly GA Req	RPB	IRS	Tray Size	Total Trays	Total ft2/wk
MAY	28ft	7	1ft	72	3 * 1.6ft2	5ft2
JUN	28ft	7	1ft	72	3 * 1.6ft2	5ft2
JUL	28ft	7	1ft	72	3 * 1.6ft2	5ft2

Seed Tray Planning Chart

Crop: _____

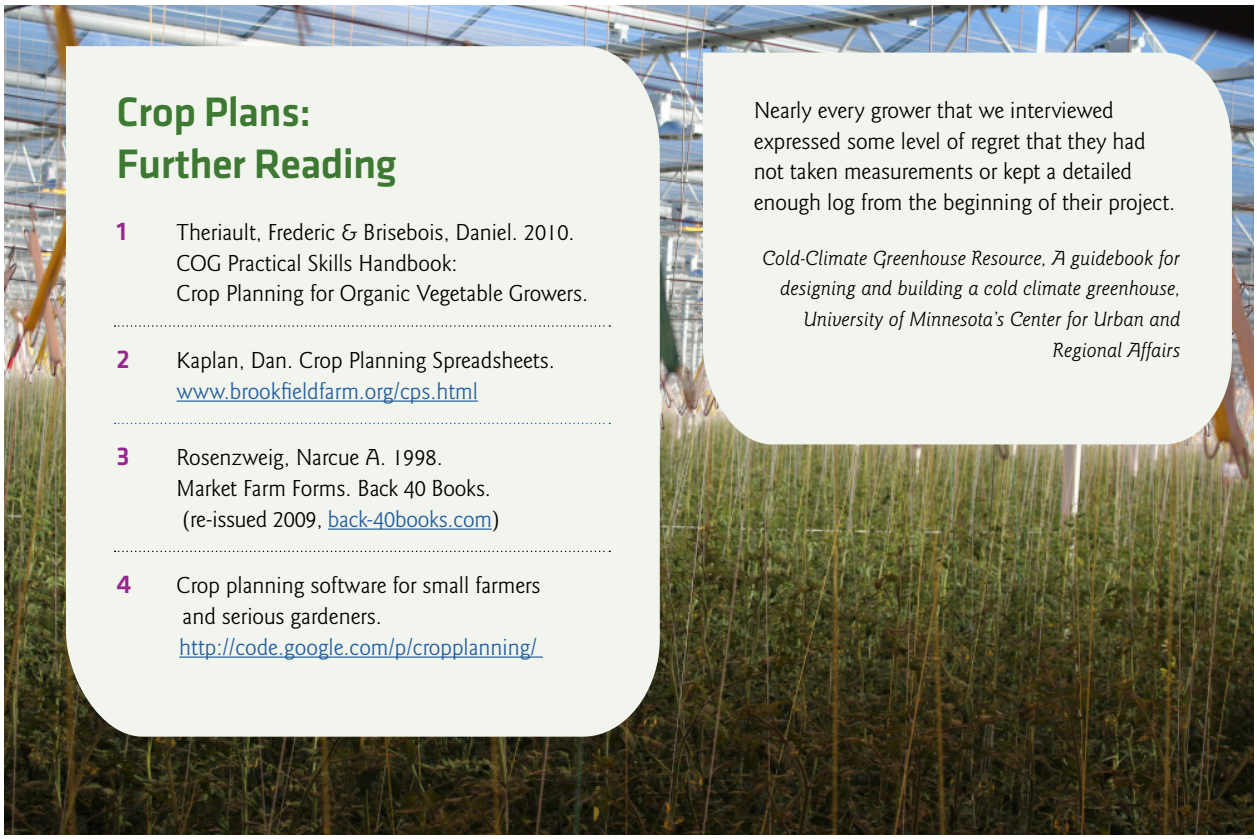
Harvest Date		GA per Planting	RPB	IRS	Tray Size	Total Trays	Total ft2/wk
MAY							
JUN							
JUL							
AUG							
SEPT							

Growing Area Chart

	Total Area for Trays	Total Area for Pots	Total Area for Vertical Systems	Total Area for Beds*	Monthly GA Req
MAY					
JUN					
JUL					
AUG					
SEPT					
OCT					

This is the total space you will need just for growing – it does not consider space for walking between beds or space for planting and transplanting. Also consider where and how much extra space you will need for storing greenhouse equipment, for an office, for a check-out area and any other spaces you may need to operate your greenhouse. Will you need to expand down the road? Do your dimensions give you room to grow? You should be able to project the dimensions of your greenhouse based on your production predictions and extra space considerations:

1. Length
2. Width
3. Height
4. Total Growing Area



Crop Plans: Further Reading

1. Theriault, Frederic & Brisebois, Daniel. 2010. COG Practical Skills Handbook: Crop Planning for Organic Vegetable Growers.
2. Kaplan, Dan. Crop Planning Spreadsheets. www.brookfieldfarm.org/cps.html
3. Rosenzweig, Narcue A. 1998. Market Farm Forms. Back 40 Books. (re-issued 2009, back-40books.com)
4. Crop planning software for small farmers and serious gardeners. http://code.google.com/p/cropplanning/

Nearly every grower that we interviewed expressed some level of regret that they had not taken measurements or kept a detailed enough log from the beginning of their project.

Cold-Climate Greenhouse Resource, A guidebook for designing and building a cold climate greenhouse, University of Minnesota's Center for Urban and Regional Affairs

Operation Systems: Lighting, Water & Heating

Estimating the heat, light and water requirements of your greenhouse operation is critical to determining whether your design will be feasible. Using the information you now have about your expected harvest times and growing area, you can begin to think about what your greenhouse will need throughout the growing season. In the final section of this feasibility assessment you will calculate the cost of your heating, lighting and water needs using these estimates.

Heating Your Greenhouse

Adding supplementary heat to your greenhouse operation allows you to extend the growing season by starting seedlings early. Decide how early you will begin your seedlings - this decision is different for every crop. Don't forget to take into account your expected harvest dates and volumes!

To estimate the amount of fuel your greenhouse will use to maintain an ideal temperature range, complete the *Monthly Fuel Estimate* Chart below. There are four key pieces of information to gather:

1. The total growing area of your greenhouse – flip back to page 20 for that number
2. The materials you have chosen to frame and glaze the greenhouse
3. The heating system and fuel source you have chosen Your community's average monthly temperatures - check Environment Canada's average temperature chart: http://climate.weather.gc.ca/climate_normals/index_e.html.

Cold Hardy And Heat Loving Seedlings

Some seedlings prefer cooler temperatures, while others like the heat. It is important to consider the types of seedlings you will be starting early in the season – do they germinate at similar temperatures? How will you manage crops with different heat needs?

Heat loving plants need temperatures of 18°C – 25°C. This means more heat outputs if you plan to start them early in the season

Select one of several online calculators available to calculate the minimum BTU output for your fuel source. Record the answers in the chart provided. The monthly fuel projection will be needed in the Costs and Revenue section of this feasibility assessment to see if your planting schedule, production size, and estimated fuel consumption is financially viable.

Monthly Fuel Consumption Estimate

	Average Monthly Temperature	Minimum BTU Output	Monthly Fuel Projection
APR			
MAY			
JUN			
JUL			
AUG			
SEPT			
OCT			

Supplementing Lighting

Not all greenhouses need supplemental lighting. Most plants need 16 hours of light per day and 8 hours of darkness at night. If you have limited daylight during the first weeks of the growing season, you may need to add grow-lights to ensure your crop's light needs are being met. Some growers may choose to produce high profit crops in a closed system that requires artificial lighting for the entire life cycle of a crop, like microgreens or mixed greens sold during the winter months.

Determine how many hours of additional light your crops will require, then contact your grow-light supplier or closed system technology supplier to find out how much energy your grow lights consume in kilowatt hours (kWh). This information can be used to assess your estimated energy costs (contact your local utility company for commercial rates) and determine if your crops, schedule and light needs are feasible.

Water Consumption

It is important to consider water consumption at the feasibility stage – will you have access to enough water to operate your greenhouse for the whole season? Is your irrigation system efficient enough to conserve water if you need to? By estimating your water needs in advance, you can be ready for any costs associated with your seasonal water use.

Water use will fluctuate based on the maturity of the plant, the size of the container, the substrate material, the aridity of the local environment, and the capacity of the irrigation system. With so many factors impacting water consumption, the most accurate measure is to carefully monitor water use in the first year. However, for the purposes of feasibility, the industry standard of 7-8 litres per square metre of growing area is useful.

The total growing area is calculated in square feet, so you will need to convert it to square metres (there are plenty of handy conversion calculators available online.) Multiply the total area in square metres by 8 to get the maximum estimate of water consumption for your crops. Contact your municipality for water rates to determine how your water use will be assessed and estimate your costs for the season.

Assessing the Feasibility of Your Design Plan

This section has guided you through a simple plan for the design of your greenhouse. You have established your harvest projections based on your estimates of demand, used this information to determine how much space you require for seedlings and mature plants, and estimated your heat, energy and water needs based on your greenhouse size and crop type.

How Much Light Will My Plants Get?

To determine if your plants will be getting enough light, enter your start dates and location into an online daylight calculator. It will be able to tell you the hours of light per day for any day in your growing season.

Not getting a full 16 hours for every week of your production schedule? It may be time to start looking supplemental lighting options.

Consider the Feasibility Questions Below:

- ☐ Do you have enough space to meet your harvest projections?
- ☐ Is the season-length you proposed practical for meeting your harvest projections?
- ☐ Is it reasonable to think you can afford to heat, light and irrigate the amount of time and space you are proposing?

If you are able to check off each of these questions with a "yes", you are ready to move on to the next section! Keep your design planning work, as you will need it to calculate costs in the next section: *Accounting for a Feasible Greenhouse*.

Part 3

Accounting

The final part of this feasibility assessment will explore the core business and accounting concepts you will need to determine if your greenhouse is financially feasible. Use this section to work through, revise and refine your design choices before you have committed any funds to the venture.

To assess the feasibility of your greenhouse operation, you will need a complete picture of all of your costs. The following sections will help you identify and calculate estimates of your costs, then determine whether the expected revenue from selling your crop will cover your costs.

Start-Up Costs

Building your greenhouse will be a significant financial commitment. Costs will include raw materials, constructing your greenhouse, operation systems (investments in irrigation, heating, ventilation systems) and tools and other supplies. Identify all of your initial investments in the Start-up Costs Planning Chart:

Construction Costs

The raw materials you will need to construct your greenhouse go in the first section

Operation Costs

To maintain an optimal growing environment, your greenhouse will likely need a few systems to regulate and operate it – heating, irrigation, ventilation, computerized monitoring, etc. There are high-tech and low-tech options, some much more costly than others. In the Operations section tally the costs of purchasing and installing the systems that meet the needs of your operation.

Tools and equipment

The last type of start-up cost to consider is tools and equipment: what will you need to help you accomplish all of your growing, operating and selling activities?

Labour

There will likely be start-up costs attributed to the labour required to construct the greenhouse and any additions made to it such as a storefront, processing room and equipment room. There may also be labour costs associated with your operations systems such as with the installation and training of growing, irrigation and ventilation systems.

Having identified your all your start-up costs you now know how much the initial capital investment in your business will be. This information is important for building a strong business plan and approaching lenders, such as your local bank, for a loan.

Variable costs

Variable costs are expenses that can be estimated in your first year based on the scale of your production. They are a direct reflection of your anticipated production. Identify your consumables and sales costs in the Variable Costs Chart.

Understanding Depreciation

Depreciation refers to the amount (per year) you must budget to eventually replace your assets when they reach the end of their lifespan.

To calculate depreciation: DIVIDE the cost of the item by its projected life.

Paying your depreciation fees ensures that you will have the funds to replace your assets when they reach the end of their lifespan or to recover from equipment failure.

Funding Your Operation

There are federal and territorial funding programs that support NWT growers who are starting small businesses. A capital investment could help you overcome the high costs of starting a commercial greenhouse and provide financial stability

Start-up Costs Planning Chart

	Amount ($)	Projected life (yrs)	Depreciation*
Construction			
Greenhouse structure			
Greenhouse glazing			
Shipping of materials			N/A
Customs			
Tools & Equipment			
Tools			
Office Equipment			
Misc. Equipment			
Operation			
Growing System			
Heating			
Water Supply			
Fertilizer			
Ventilation			
Labour			
Greenhouse Labour			N/A
Operations Systems Labour			N/A
Total Start-up Costs			

Costing Out The Variables

There are plenty of great online resources and calculators that can help you to estimate your consumables: fertilizer, chemical concentration, amount of substrate per container, etc.

Variable Costs Chart

Containers	CONSUMABLES COSTS	
Growing Media (substrate)		
Starting plant (Plugs, cuttings, seed)		
Tags, Stakes, Trellis, Etc.		
Fertilizer		
Chemicals		
Shipping	SALES COSTS	
Packaging		
Storage		
Marketing		
Vendor Fees		
Total Variable Costs		

Consumable Item Cost

Consumable item costs are the supplies that are considered day-to-day items. Items such as non-reusable growing containers, substrate, fertilizer, and plugs and seeds would all go under this category.

Sales Cost

Your sales costs are what you pay to get your product to market. Selling your product directly from your greenhouse reduces your sales costs, but you might need additional equipment to package, store and sell the produce to your customers. Distributing your crops for sale outside of your greenhouse may require shipping and/or vendor fees for farmers markets.

Having a handle on your variable costs going into the first year is just another way to anticipate upcoming expenses. In the years to follow you can assess the variable costs on a per crop basis as each crop requires a different amount of resources.

Fixed Expenses

Fixed expenses are your bills - things that you will have to pay regularly to support your operation. Identify fixed expenses using the instructions below to ensure that you will have paid all your bills while your greenhouse is active. For each cost below, calculate a monthly estimate - keep in mind that these costs should be divided amongst only months your greenhouse is in operation.

Greenhouse property loan payment

This will be the monthly interest on your loan. Use the total start-up costs you identified in the start-up costs section to work with lenders like your local bank for an estimate on what this figure will be. Loan payments are consistent throughout the year, so be sure to divide the total payments you will make in a year by the number of months your greenhouse is in operation.

Depreciation

You identified the total depreciation cost in your *Total Start-up Costs* chart. Divide this amount by the number of months your greenhouse will be in operation to estimate the monthly payment on depreciation.

Property Taxes/ Leases

Account for your monthly rent or lease on the property you will be using. If you are purchasing land, make sure you get an assessment of the land. This payment is consistent throughout the year, so be sure to divide the total payments you will make in a year by the number of months your greenhouse is in operation.

Insurance

Protect your investment by insuring it, as well as the essential equipment needed in your day to day operations. You can use the estimates in the *Total Start-up Costs* chart to approach insurance companies for an estimate. This payment is consistent throughout the year, so be sure to divide the total payments you will make in a year by the number of months your greenhouse is in operation.

Labour

Depending on the size of your greenhouse and how involved you are in the sales model you will require differing amounts of staff and staff with different qualifications. If you have an active role in the business, paying yourself is also important to understand your business profits. Divide the cost of labour by the number of months your greenhouse is in operation.

Electricity

In the *Design Planning section*, you estimated the energy needs of your heating and lighting systems in kWh. Contact your local utilities provider to find your kWh costs. Energy consumption is likely to be higher in the early months of production when you are supplementing heat and light more aggressively. For a more accurate estimate, calculate your monthly kWh consumption and average the total across the number of months your greenhouse is in operation. Monitoring and recording energy consumption in the first year will be critical to budgeting accurately for your electricity needs.

Fuel

In the *Design Planning section*, you estimated your heating needs. Fuel consumption is likely to be higher in the early months of production when you are supplementing heat and light more aggressively.

Water

In the *Design Planning section*, you estimated your water consumption in litres. Using this estimate, contact your municipality or water delivery service to find out how much you can expect to pay for water.

Training

Consider whether you or your staff will need training during the year. In the NWT, it is hard to predict the pool or quantity of qualified potential employees, but you may find that training is well worth the investment if you can build capacity in your workforce. Check out the courses offered at the Northern Farm Training Institute in Hay River at www.nftinwt.com.

Divide the cost of training by the number of months your greenhouse is in operation.

Office operating expenses:

This includes annual expenses like marketing, accounting promotional expenses, and legal expenses. Divide the cost of annual office operating expenses by the number of months your greenhouse is in operation.

Total Fixed Expense per month
Total Fixed Expenses per season

Total Costs

Use this chart to calculate the total sum of all of your costs for the first year. This will include start-up costs, variable costs and fixed costs identified in this section. Include any other costs that have not been considered in this section.

Total Costs Chart

Start-up Costs	
Variable Costs	
Fixed Costs	
Other Costs	
Total Cost:	

Did you know?

The Government of the Northwest Territories (GNWT) department of Industry Tourism and Investment (ITI) has market development program for agriculture. Part of the program provides money to help offset freight costs. So, getting your product to another community might be cheaper then you thought. For more information check out the following link or contact your local ITI department: www.iti.gov.nt.ca/programs-services/market-development-program

Projected Sales

Now that you have estimated the total cost of running your greenhouse for the season, you can determine whether your greenhouse is financially feasible by projecting your sales for the season to find your expected revenue.

Use your unit totals from the *Total Weekly Harvest P*rojections chart in the Design Planning section to complete the Price and Projected Sales Chart. The calculation for projected sales is: (price per unit) x (total units) = projected annual sales

Projected Sales Chart

Crop	Price per Unit	Total Units	Projected Annual Sales
Total Projected Sales:			

Total Revenue

Using the chart below, calculate your total revenue from all sources:

Revenue Source	*Revenue Amount*
Projected Sales	
Total Revenue:	

Assessing Financial Feasibility

To see if your business is profitable you will need to subtract your expenses from your annual revenue:

Total Expenses	
Total Revenue	
= Profit Margin	

If you have a healthy profit margin – that is, your greenhouse is making money – congratulations! Sounds like a commercial greenhouse is a great fit for your community, you have a feasible design plan and your finances are sound. The next step is to compile a full business plan for your operation. A standard business plan includes financial projections to up to 5 years and thoroughly documented expenses.

If you are in the red – that is, your greenhouse is losing money – do not despair! Some aspect of your plan is not working with the other pieces. By re-visiting the *Community Readiness* section and the *Design Planning* section you may be able to experiment with different variables to improve the feasibility of your greenhouse idea.

Strategies For Improving Feasibility:

Less expensive glazing and framing materials would reduce the fixed expenses considerably

If heating the greenhouse is very expensive, investing in glazing material that holds more heat might be the best option.

The size of your greenhouse could be too large or too small – experiment with different crops and sizes to find something more profitable

If fuel and energy consumption costs are high, try shortening your growing season to reduce consumption in the cooler months.

Increasing your total growing area with vertical growing systems and outdoor growing space could bring some extra revenue into the operation without making serious changes to the greenhouse plan.

Bedding plants and ornamental crops can bring in a great deal of revenue relative to the effort they take to grow – consider adding some of these high value crops to your plan

If you have crops with a lot of heat, light, fertilizer and water needs, try replacing them with lower-needs crops with higher profit margins.

Look for ways to make your existing greenhouse design more energy efficient: thermal blankets, infra-red screens, better insulation for greenhouse walls/base are all techniques that can bring down fuel and energy costs.

If you are designing a brand new greenhouse, consider more energy efficient greenhouse designs with passive solar heating, thermal banking , closed system growing units and LED technology.

Revenue Sources

Profit from sales is the most sustainable revenue source for a commercial greenhouse. Selling produce is the most sustainable revenue source for a commercial greenhouse. You may also have other sources of revenue, such as grants, loans tax credits, donations, subsidies, etc. Be sure to include other types of revenue in your total revenue to get an accurate understanding of the financial feasibility of your operation.

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