KASLO/RDCK AREA D PARTNERSHIP

Climate Change Adaptation & You

Appendix A – Charting the Impacts

The change in climate, ecosystem response and resultant community-felt impacts were initially drawn up as a flow chart, by season. These findings were translated into tabular form.

Food production

1.	Increased air temperature, extreme conditions and lower summer rainfall leading to ***fire risk to crops and buildings*** (summer, fall)
2.	Increased air temperature leading to ***crop disease*** (fall)
3.	Late frost, reduced summer precipitation, increased air temperatures, increased maximum temperatures, decreased winter snowfall, increased severe rain storms leading to ***reduced farm productivity, crop failure*** (fall, winter, spring, summer)
4.	Increased air temperature, decreased winter snowfall but increased rainfall leading to ***soil damage and erosion*** (winter, spring, summer)
5.	Increased growing degree days leading to ***successful crop varieties, more produce*** (spring, summer)
6.	Increased occurrence in intense rain / snow storms and increased winter precipitation leading to transportation disruptions, road closures and **produce shortages** (winter)
7.	Increased frost free days, increased growing degree days, increased spring precipitation, heavy rain on unfrozen ground, increased air temperatures and seasonally late lightening storms leading to ***higher farm costs / land contamination*** (spring, summer, fall, winter)
8.	Increased air temperature leading to ***livestock mortality*** (summer)

Water Supply and Quality

1.	Increase in air temperature, and reduced snowfall lead to ***water supply in wells and reservoir storage being affected*** (spring)
2.	Reduced spring snowfall, higher air temperature, increased growing degree days, and longer periods of little or no precipitation lead to ***demand exceeding supply*** (spring, summer, fall)
3.	Higher air temperatures and Increased extreme events lead to ***potential increase in watershed damage*** (fall, winter, spring)
4.	Warmer air temperatures, increased occurrence of wind storms and intense rain events lead to ***water contamination / higher water treatment costs*** (summer, winter)
5.	Extreme rainfall events, increased occurrence of wind storms and increased snow storm frequency lead to ***water supply interruption*** (spring, summer, winter)
6.	Decreased winter snowfall and extreme cold events lead to **water infrastructure damage (frozen water pipes)** (late fall, early winter)

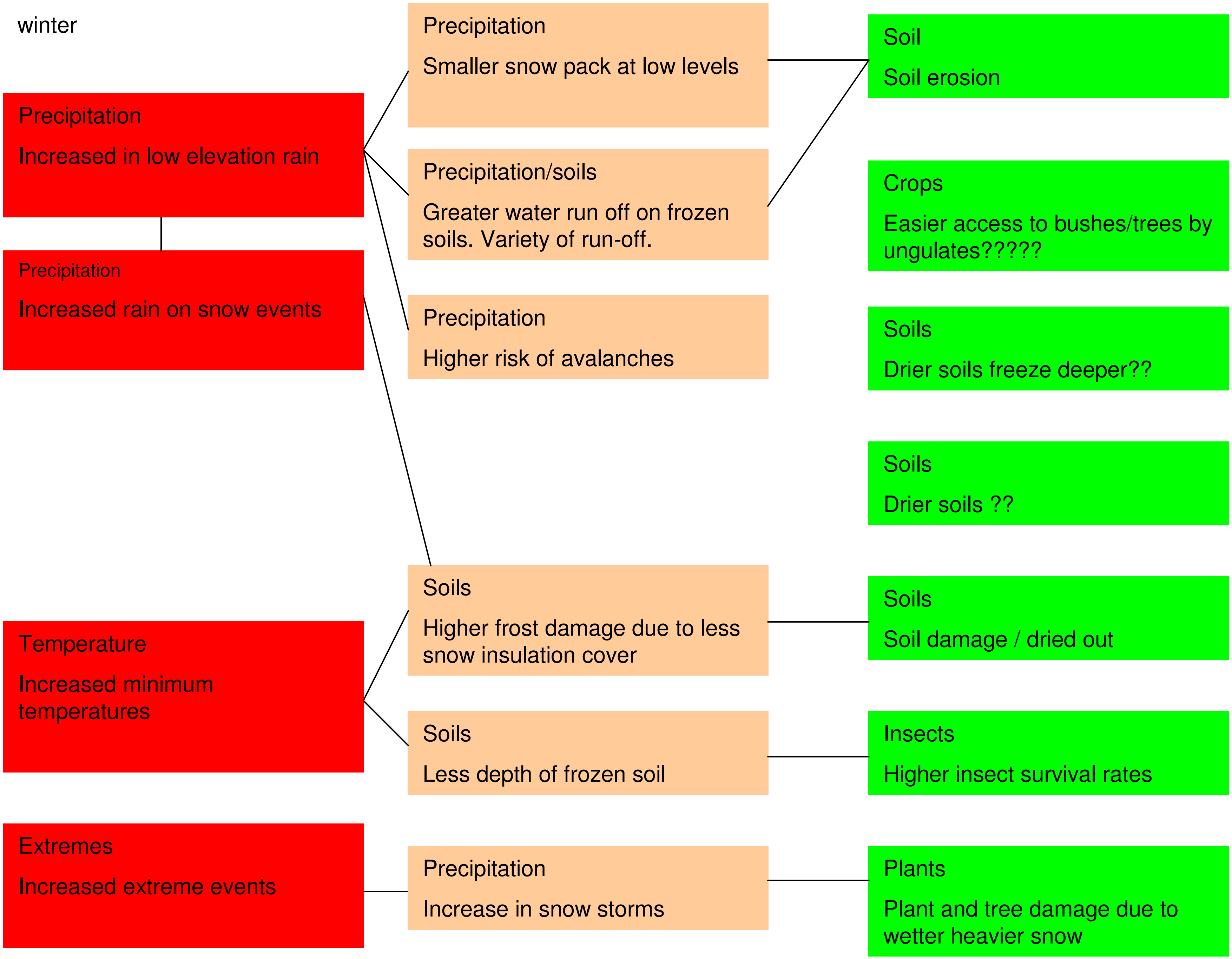
Kaslo & Area D Climate Change Impacts on Agriculture Provision – INITIAL DRAFT

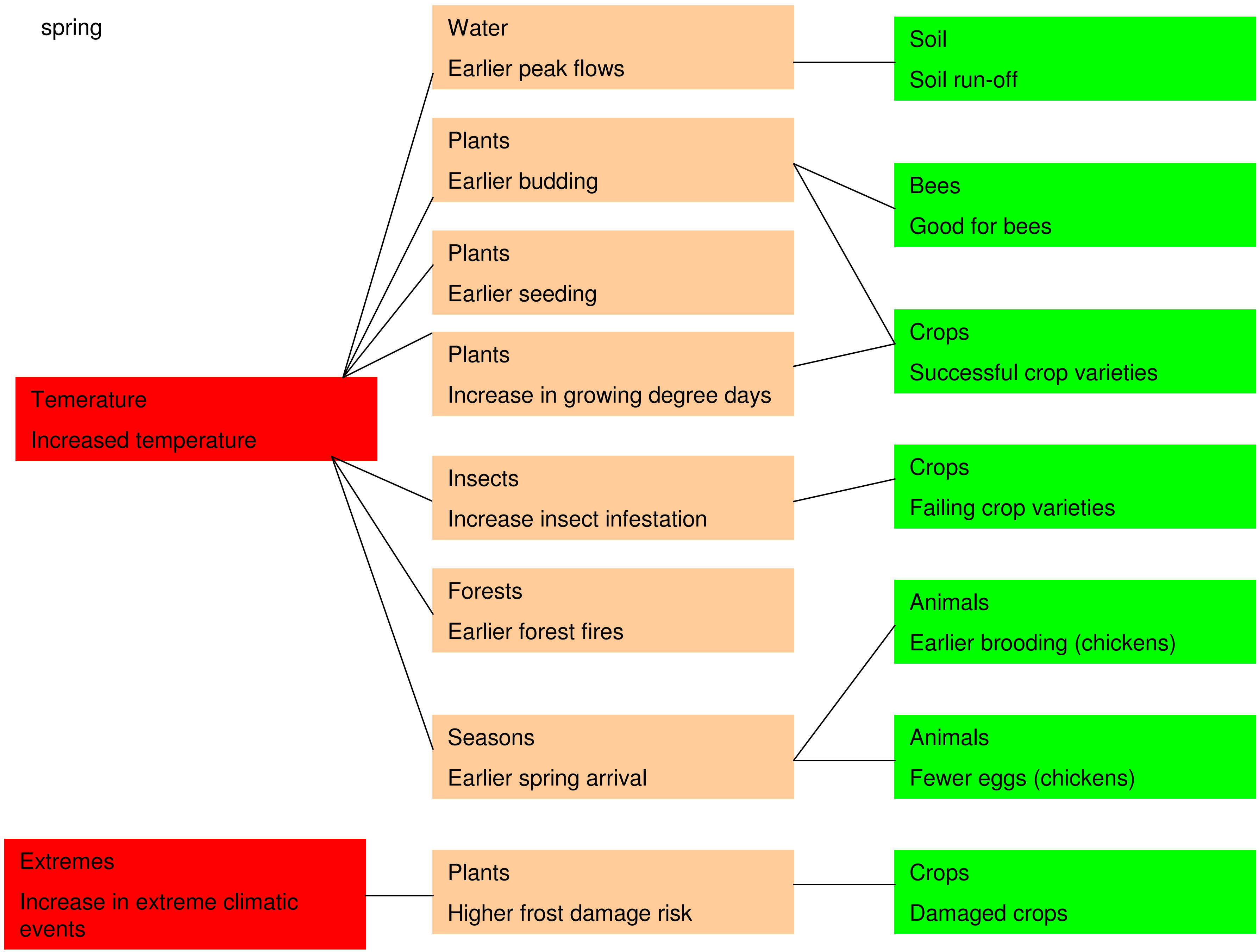
March 19, 2010

CLIMATE

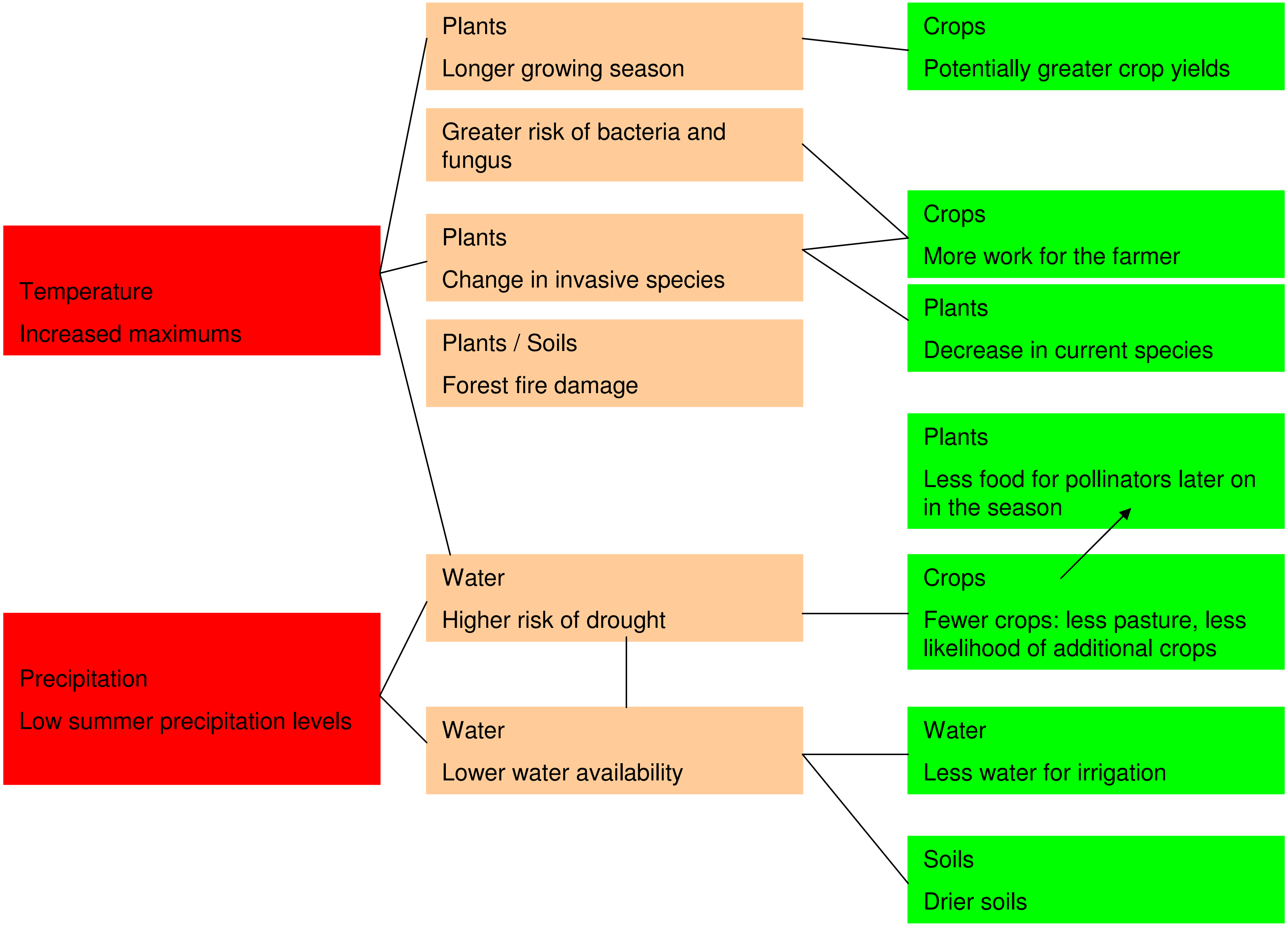
ECOSYSTEM RESPONSE

IMPACTS


winter
Precipitation
Increased in low elevation rain
Precipitation
Increased rain on snow events
Temperature
Increased minimum temperatures
Extremes
Increased extreme events
Precipitation
Smaller snow pack at low levels
Precipitation/soils
Greater water run off on frozen soils. Variety of run-off.
Precipitation
Higher risk of avalanches
Soils
Higher frost damage due to less snow insulation cover
Soils
Less depth of frozen soil
Precipitation
Increase in snow storms
Soil
Soil erosion
Crops
Easier access to bushes/trees by ungulates?????
Soils
Drier soils freeze deeper??
Soils
Drier soils ??
Soils
Soil damage / dried out
Insects
Higher insect survival rates
Plants
Plant and tree damage due to wetter heavier snow


spring
Water
Earlier peak flows
Plants
Earlier budding
Plants
Earlier seeding
Plants
Increase in growing degree days
Temerature
Increased temperature
Insects
Increase insect infestation
Forests
Earlier forest fires
Seasons
Earlier spring arrival
Extremes
Increase in extreme climatic events
Plants
Higher frost damage risk
Soil
Soil run-off
Bees
Good for bees
Crops
Successful crop varieties
Crops
Failing crop varieties
Animals
Earlier brooding (chickens)
Animals
Fewer eggs (chickens)
Crops
Damaged crops

Summer/Fall



Temperature
Increased maximums
Precipitation
Low summer precipitation levels
Plants
Longer growing season
Greater risk of bacteria and fungus
Plants
Change in invasive species
Plants / Soils
Forest fire damage
Water
Higher risk of drought
Water
Lower water availability
Crops
Potentially greater crop yields
Crops
More work for the farmer
Plants
Decrease in current species
Plants
Less food for pollinators later on in the season
Crops
Fewer crops: less pasture, less likelihood of additional crops
Water
Less water for irrigation
Soils
Drier soils

Questions:
Potential strategy
water collecting tanks for storage
Greenhouses are part of a solution

Concern
what about the impact on the natural world

Questions
Do we need to go to greenhouses or can we grow all outside?
What do we need to do to become self sufficient in food?
Do composting rates increase, adding nutrients to the soil? Not winter – spring/summer/fall
How will frozen soil depth change due to less snow cover/insulation? More overall? Less?
Will cloud cover change?
Will the soils really be drier over winter?
Do we include greenhouse impacts? Artificial climates….
Will spring arriving earlier affect the rate of chickens laying eggs?
Will GMOs and insecticides be brought in to the impacts?
Need - Where are the seed variety trials? Need info on seed availability and sourcing. CBT database.
Early pollinators may not be good for bees – no flowering.
Need – plant suitability for the region. What impact CC on worldwide seed availability?
How can we easily adapt to variations over years?
Plan for worst case scenario
Will our soil become more acidic (more water, anaerobic fermentation due to increase temp)

Kaslo & Area D Climate Change Impacts on Water Provision

– INITIAL DRAFT

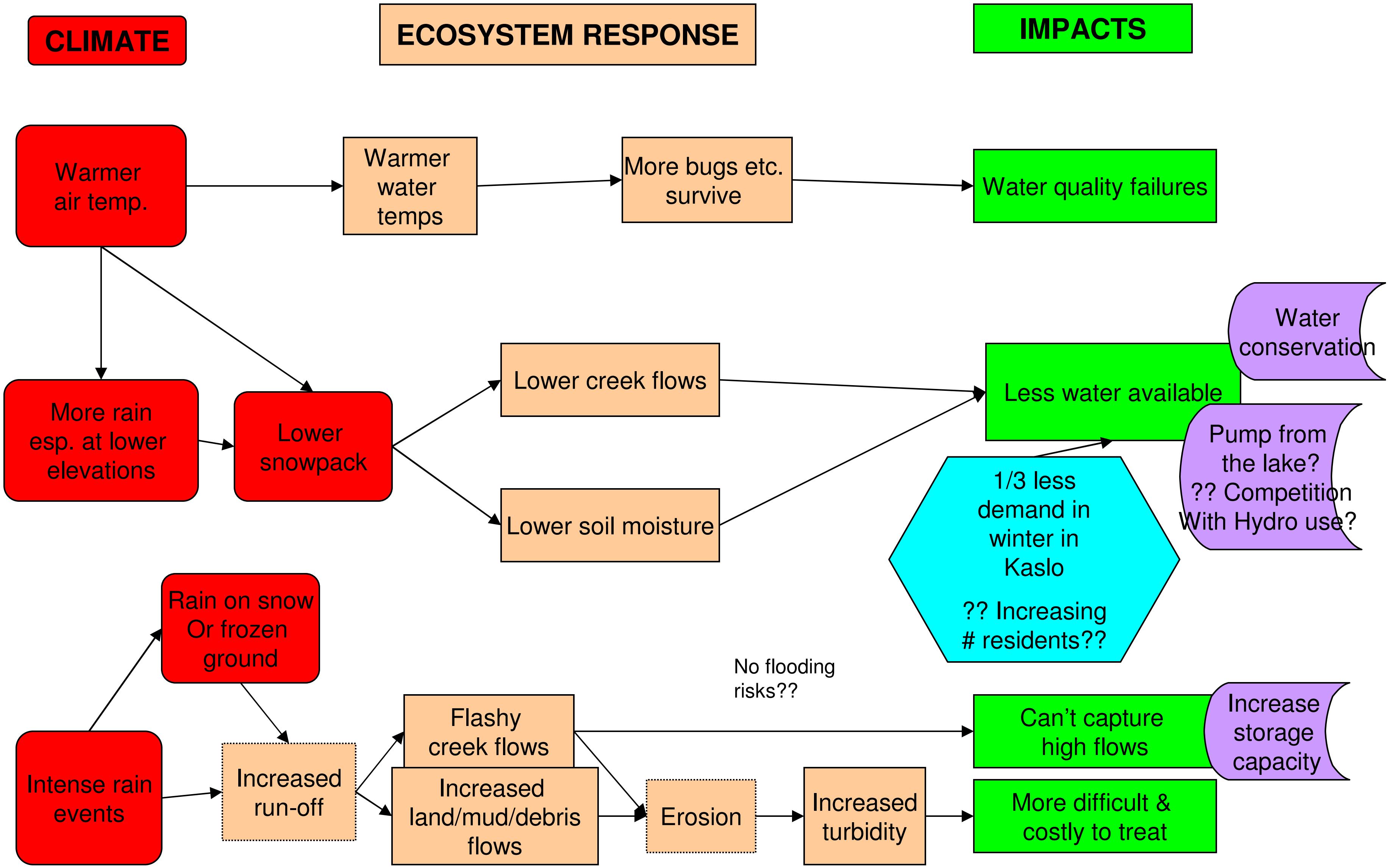
March 19, 2010

Ground water

- Status/shortages unknown
- Ask well drillers
- As surface water supplies decline and there are more conflicts amongst users, some may turn to wells which will increase groundwater use with possible impacts
- Do changes in lake levels impact on shallow wells beside lakes?

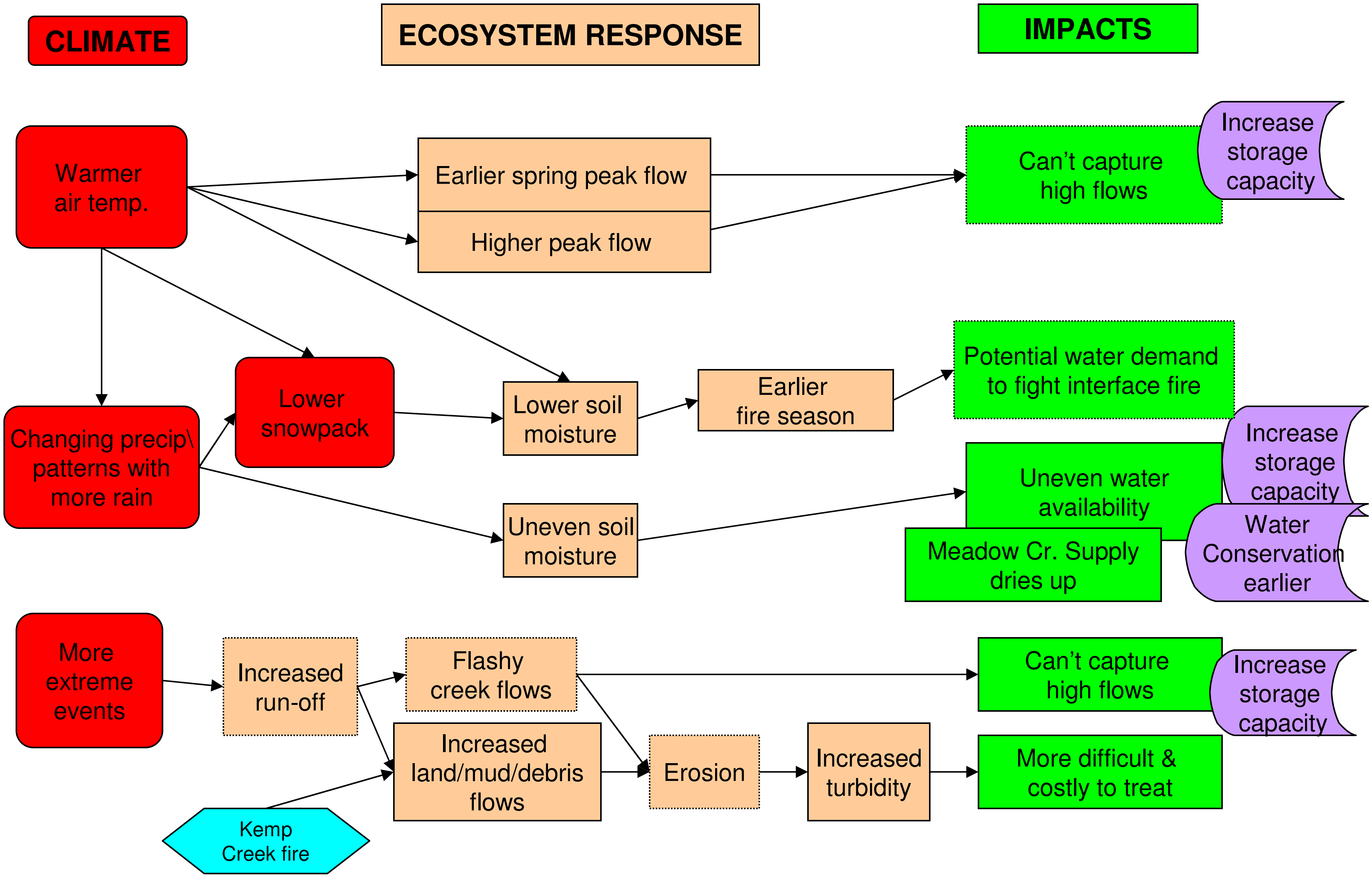
Kaslo & Area D Climate Change Impacts on Water Provision

WINTER (Dec. – Feb.)



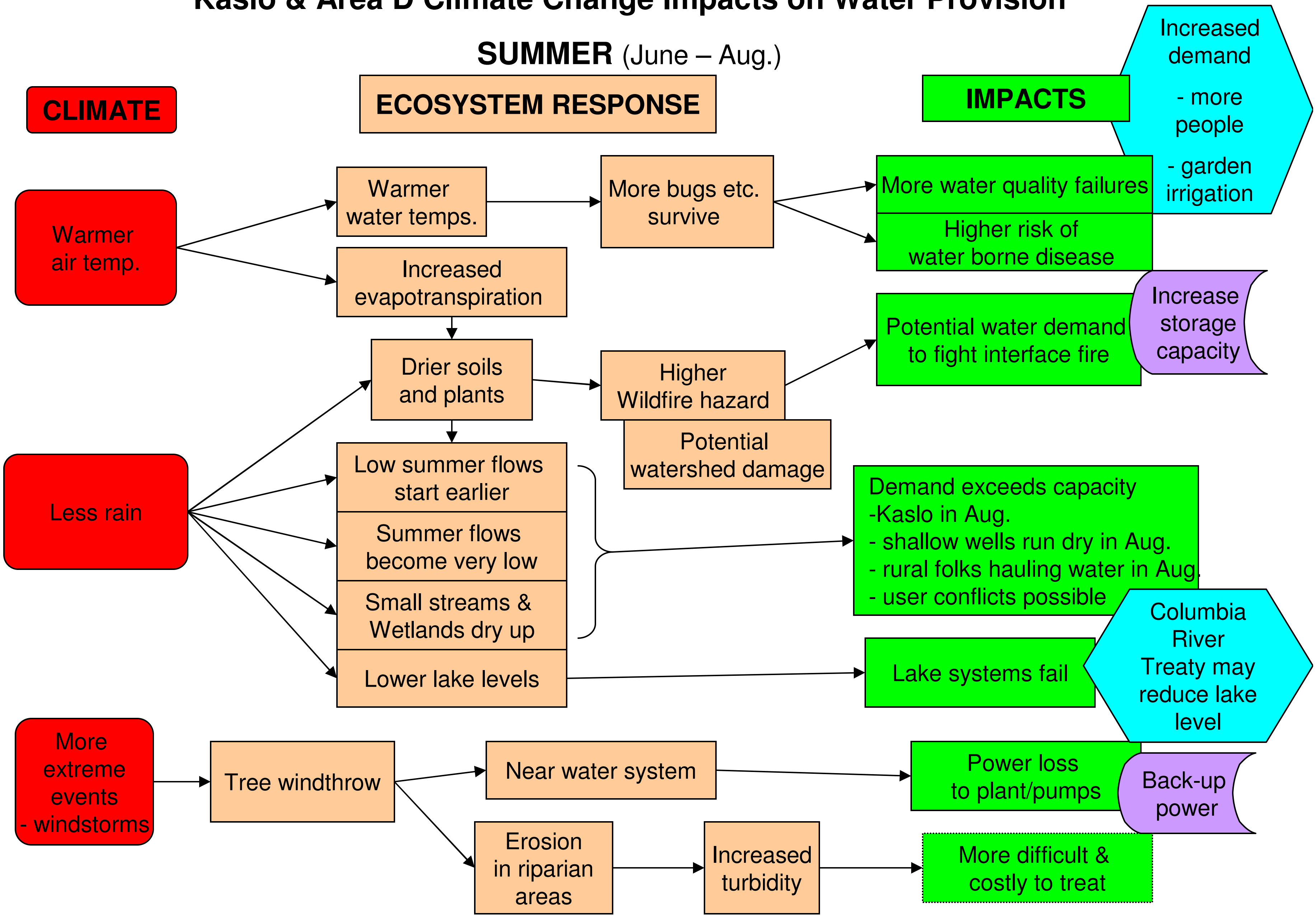
Kaslo & Area D Climate Change Impacts on Water Provision

SPRING (March - May)



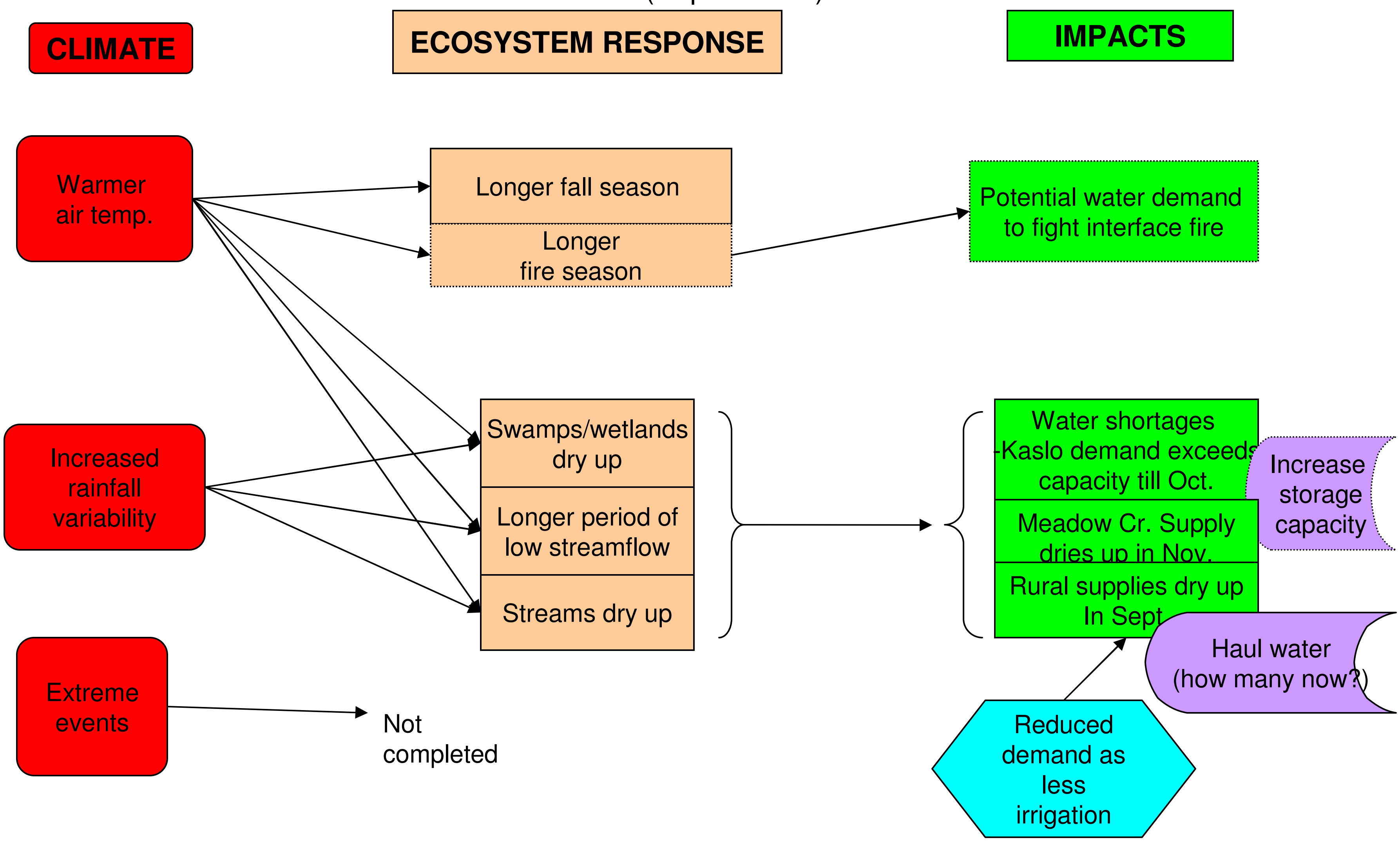
Kaslo & Area D Climate Change Impacts on Water Provision

SUMMER (June – Aug.)



Kaslo & Area D Climate Change Impacts on Water Provision

FALL (Sept. – Nov.)



Appendix B - Assessing risk / identifying options

The impacts were assessed against the probability of the impact occurring and the consequences for a community if the impact occurred. The individual impacts were built into an assessment matrix, shown below, for both study areas. This information helped evaluate priority levels and provided a strong direction for the Steering Committee when drawing up action recommendations and subsequent priorities.

The arrows in the food matrix relate to the assessment of ‘farming costs’. No firm decision could be reached on where it lay on the probability scale.

Probability assessment

Rating	Recurrent events	Single events
Almost certain	Could occur several times per year	More likely than not – probability greater than 50%
Likely	May arise about once per year	As likely as not – 50/50 chance
Possible	May arise once in the next five to ten years	Less likely than not but still appreciable. Probability less than 50% but still quite high
Unlikely	May arise once in the next 10-25 years	Probably not but still appreciable – probability low but noticeably greater than zero
Rare	Unlikely during the next 25 years	Negligible – probability very small, close to zero

Risk assessment

<table>
<tr><th></th><th>Public safety</th><th>Environment</th><th>Community and lifestyle</th><th>Local economy and growth</th><th>Public Administrati on</th></tr>
<tr><td>Insignificant</td><td colspan="5">Minor issues or shortfalls but of little or no concern to you or your community.</td></tr>
<tr><td>Minor</td><td colspan="5">Isolated cases but of no lasting nature.
Mildly disruptive to some individuals or families.</td></tr>
<tr><td>Moderate</td><td colspan="5">Related issues will require a degree of attention.
Some public knowledge or awareness.
Inconvenience but no lasting damage will be felt by local community.</td></tr>
<tr><td>Major</td><td colspan="5">Issues would be in the public domain and would demand fairly urgent attention. Widespread but localized inconvenience might last a couple of days. Local communities would have to make alternative arrangements, working with other neighbours.</td></tr>
<tr><td>Catastrophic</td><td colspan="5">Breakdown in the chain of events, widespread concern and long-term damage to systems, lasting a period of weeks or months.
Could alter immediate lifestyle for a period of time.</td></tr>
</table>

Action assessment

Negligible- No action required

Low- Some actions (public education) may be desirable

Moderate- Some controls required to reduce risk to lower levels

High - High priority control measures required

Very High - Immediate controls required

Risk Assessment Matrix

Food production

Consequence	Remote	Unlikely	Possible	Likely	Almost Certain
Catastrophic					
Major				Fire risk Crop disease Crop failures Soil damage Road closures Successful crops	
Moderate			Livestock mortality Farming costs	Farming costs	
Minor					
Insignificant					

Probability (2050)

Risk Assessment Matrix

Water supply and quality

Consequence	Remote	Unlikely	Possible	Likely	Almost Certain
Catastrophic				Water supply in wells/ reservoirs Demand exceeding supply Water interruption	
Major			Frozen pipes and infrastructure damage Bugs/ water contamination	Watershed damage	
Moderate			Water contamination from storms		
Minor					
Insignificant					

Probability (2050)

Risk Assessment of the identified climate related impacts
Once the climate related risks were identified, a risk assessment was carried out on each, again divided into water and food issues. The identified risks, plotted with respect to consequence and probability, are identified as below:

Very high risk (major consequence/almost certain probability): immediate controls needed
water - decreased water supply in wells and reservoirs, demand exceeding supply, water supply interruption
agriculture - none

High risk (major consequence, likely probability): high priority control measures required
water - watershed damage
agriculture - fire risks to crops and buildings, increased crop disease, reduced productivity, soil damage, road closures, successful crops

High risk (moderate consequence, possible probability): high priority control measures required
water - frozen pipes and infrastructure damage, water contamination from bugs/bacteria
agriculture - none

High risk (moderate consequence, likely probability): high priority control measures required
water - none
agriculture - increased farming costs

When considering how adaptable Kaslo/Area D was in terms of the projected risks, the following was produced:

Identifying options

Water Provision- Adaptation Options

	Climate-related Impact	**Risk** Very low Low Moderate High Very High	**Potential Adaptation Options:** What can be done?	**Adaptive Capacity:** Can we do it?
1.	Increase in air temperature, and reduced snowfall lead to ***reduced water supply in wells and reservoir*** (spring)	**Very High**	<u>Focus on supply</u> Deforestation – trees Watershed management Plot different species, higher temp tolerance, shade species Create wet land for recharge, storm management, filtration Higher dam Expand riparian buffers	**Low** Watershed management strategy Land managers cooperative (licensees, government, forestry) Very expensive, not very well spent.
2.	Reduced spring snowfall, Higher air temps, Increased growing degree days, Longer periods of little or no precipitation, lead to ***demand exceeding supply*** (spring, summer, fall)	**Very high**	<u>Focus on demand</u> Meters Low flush toilets Education (rainbarrels reduce water for lawn care, save $$ in treatment) Drip irrigation Xeriscaping Building code – graywater, compost Kaslo creek for golf course/gravity	**High** Incentive program Lower $$ than supply option $500 000 meter/toilet in each house Retrofit more expensive Difficult, cultural, new management **Low**
3.	Higher air temperatures and Increased extreme events lead to **increased watershed damage** (fall, winter, spring)	**High**	More buffer zones More vegetation More deciduous trees More sedimentation ponds More infiltration galleries	All can be done Very expensive **Low**

4. 4a	Increased occurrence of wind storms and intense rain events lead to **water contamination** (summer, winter) Bacteria = turbidity (???)	**Moderate** **high**	Biofilters Vegetated buffers Biowater (???) Wetlands (combined with above) Start tomorrow planning Minimise impervious surface No more pavement Household filters (POE)	Some easy Some hard Possible/practical Some resources **Moderate**
5.	Extreme rainfall events, increased occurrence of wind storms and snow storm frequency lead to power loss and **water supply interruption** (spring, summer, winter)	**Very high**	Backup system/standby power plant Alternative energy system/water system Redundancy (??) Underground power lines/utilities Wider right of ways/buffers Run of river – Kaslo river, need fish ladder	**Moderate** Possible Quite expensive $$ Possible, better in future, prices go up. Cost/kwh too low.
6.	Extreme cold events, decreased winter snowfall and less snow insulation lead to **water infrastructure damage** (frozen water pipes) (late fall, early winter)	**High**	Blow snow on pipes Bury deeper Permit stage – pipe burial depth minimum Water run in pipes	**High** Head thickness (barrier) Old pipes are leaking anyway. Dig up and bury deeper.

Agriculture - Adaptation Options

	Climate-related Impact	**Risk** Very low Low Moderate High Very High	**Potential Adaptation Options:** What can be done?	**Adaptive Capacity:** Can we do it?
1.	Increased air temperature, extreme conditions and lower summer rainfall, prolonged fire season lead to **increased fire risk to crops and buildings** (summer, fall)	**High**	Fire interface Fire smart-ing Emergency preparedness Incentives to enable upgrades	**High** Provincial $$ needed
2.	Increased air temperature, greater risk of bacteria and fungus lead to **increased crop disease** (fall)	**High**	Increase still set Crop rotation Diversify crops/seasonal Permaculutre/companion planting Bio-controls/not GMOs/biocides	**High** Education Enabling
3.	Reduced summer precipitation, decreased winter snowfall, increased severe rain storms lead to **reduced farm productivity, crop failure** (all seasons)	**High**	Increased storage/canning/dry Seed bank/increased production Greenhouses Drip irrigation/mulching	**Moderate** Expensive $$ Takes time More community based (**low - Andy)**
4.	Decreased winter snowfall, increased rainfall/ rainstorms, greater freeze depth potential lead to **damage and erosion** (winter, spring, summer)	**High**	Permaculture /landscape design Retention of soil/water preserving trees/plants Reforestation/slope stabilisation Catastrophic change (??)	**Moderate/high** Political Time $$
5.	Increased air temperature, strain on livestock lead to **livestock mortality** (summer)	**Moderate**	Non invasive livestock species Holistic livestock production	**High**

			Shade/water management	
6.	Increased occurrence in intense rain/snow storms, transportation disruptions lead to **road closures and produce shortages** (winter)	**High**	Increased food storage/production Emergency preparedness plan ------------------- Snow cleaning budget -----------------------------	Easy, not too many $$, No, needs leadership and $$
7.	Increased frost free days, increased bug survival, potential use of insecticides and pesticides lead to **higher farming costs/ land contamination** (All seasons)	**Medium/ High**	Share equipment Kootenay covers/greenhouses Financial incentives for agriculture etc infrastructure Catastrophic change	**Medium** With $ and support Leadership required
8.	Increased growing degree days lead to **broader range of successful crop varieties/more produce** (spring, summer)	**High**	Skills and knowledge Good Ministry of Agriculture Local initiatives eg KLAS Good crop genetics Sustainability not economic justification	**High** Already incentives in place to do these Present skills and research

Appendix C - Climate change adaptation actions

The project Steering Committee recommends that the most urgent adaptation actions and mitigation measures where appropriate are taken. The 'Climate Change Adaptation & You' project recommends the following actions:

Abbreviations
AKBLG - The Association of Kootenay and Boundary Local Governments
BC Govt – Government of British Columbia
CBT – Columbia Basin Trust
KDCFS – Kaslo and District Community Forest Society
KFSP – Kaslo Food Security Project
KLAS – Kootenay Local Agricultural Society
RDCK – the Regional District of Central Kootenay
MoA – Ministry of Agriculture and Lands
MoF – Ministry of Forests and Range
WKES – West Kootenay Eco Society
YRB – Yellowhead Road & Bridge maintenance

Water

Education
W1
Information and communication are a key component of a water strategy. Keep water licensees informed about potential future water shortages, both short term and long term, and ways on how to reduce water consumption.
Lead body: RDCK / Village / CBT

Policy
W2
More use should be made of household water before it gets sent down the drain. Collected rainwater can be used for some household purposes. Support to be given to change provincial legislation and regulations to allow grey water collection for outdoor use and rainwater for some household use.
Lead body: Village / RDCK / AKBLG / CBT

Protection of water availability and quality

W3

It is essential that water is used as efficiently as possible and not wasted. Water conservation incentives (e.g. low flow toilets, rain barrels / tanks, rainwater collection, low flow irrigation, etc.) must be encouraged for households and businesses, and links made to existing schemes. Public buildings should lead by example.

Lead body: Village / RDCK / Building owners

W4

Watersheds are an essential component of water collection. Water is stored (as snowpack), treated (filtered through the ground) and the release regulated (by vegetation). Some watershed areas lie within logging areas. It is important that forest management practices which maximise and protect water supply are supported. Damaged areas should be repaired and planted out with suitable vegetation.

Lead body: RDCK, Village, MoF, KDCFS, Other forest user licensees

W5

The present water storage facilities for the Kaslo Village are adequate for current water demand, but increasingly back up sources are needed. It is recommended that the Village research into increasing the water storage capacity of the Village reservoir.

Lead body: Village

W6

Presently little is known about how water is used – it is simply delivered. Use monitoring is an important component of water provision and options for monitoring of residential and industrial water use should be explored (for example a water metering program). Discussions should take place with known large users of water, including the golf course, as to how a reduction in the volume of water could take place.

Lead body: Village, CBT, RDCK, organised water users

W7

Warmer climates and extreme weather events can affect water quality through bacteria contamination. Advice and support should be made available to enable water user groups and publicly owned water systems to monitor water quality at intake.

Lead body: Village, RDCK, water user groups

W8

Hard surfaces can result in large amounts of surface water run-off in the event of an extreme weather event. This in turn can cause sedimentation and contamination problems in water sources. Every effort should be made to minimize or remove impervious surfaces in new building design, prior to construction, in watershed or riparian development permit area’s.

Lead body: Community, RDCK, Village

Emergency preparedness
W9
A large number of water users have to pump water using electrical pumps. Back up power is essential to ensure continued supply in the event of a power outage. High priority should be given to ongoing maintenance programmes of public or privately owned generation units. Advice should be available to those who do not currently have alternative power generation capacity.
Lead body: Village / households

W10
Overhead power lines are subject to damage in extreme weather conditions. Many households and water distribution systems rely on electricity to pump water. Fortis BC and BC Hydro have upgraded much of the areas distribution lines to reduce interruption to the supply. It is essential that maintenance and upgrading of electrical supply infrastructure is continued and for climate change projections to be incorporated into their long term planning.
Lead body: Fortis / Hydro

Monitoring
W11
Monitoring is essential as trends versus climate data can then be established over the course of time, building a picture of water supply to a watershed. There is limited supply data for Kemp Creek and none available for Bjerkness and Fletcher. It is recommended that water flow monitoring on Kemp, Bjerkness and Fletcher creek is established. Redfish watershed comparison to be continued.
Lead body: Village / CBT watershed program

W12
Require water meters on all new construction (legislated for 2014)
Lead body: Village, RDCK, Building inspectors

Food

Food supply and distribution
F1
Roads are often blocked during the winter and extreme weather conditions. There needs to be a continuation of proactive highway maintenance to ensure storm drains and creeks which flow under the highway are kept clear of debris.
Lead body: YRB, MoT

F2
Food growers and farmers need assistance in growing food crops. There needs to be an ongoing promotion of community farm equipment co-ops. The relaunch of farmer’s institutes should be explored.
Lead body: KLAS, WKES

F3
A warming climate presents opportunities as well as challenges. There is a need to monitor and record crop disease and bugs as well as new crop viability in the area.
Lead body: KFSP, KLAS

F4
The RDCK is in the process of drawing up an Area Agricultural Plan. It is important that the climate change adaptation recommendations are reflected in this and other long term plans or studies conducted by the RDCK
Lead body: RDCK, Village

F5
Local strains of food crop are an important component of adapting to climate change. There needs to be continued support and promotion for the local seed banks.
Lead body: KLAS, KFSP

F6
Tree cover is important for shade and for land stability. Identify and communicate tree planting grants / schemes and by 2012 implement active tree planting program
Lead body: RDCK, Village, WKES, landowners, community

Emergency preparedness
F7
There is an existing RDCK Emergency Preparedness Plan and Kaslo Fire Protection Plan. It is important to keep this up-to-date as new climate data comes forward and to reinforce its message to communities.
Every effort should be made to communicate the importance of fire protection to people who live outside the Kaslo Fire Protection area.
RDCK, Village

F8
By 2011, re-release RDCK Emergency Preparedness Plan to ensure thorough knowledge and understanding of the need for three day minimum food and water storage.
Lead body: RDCK

Education
F9
Support community education and incentive programme to adopt appropriate irrigation and water retention farming methods to reduce water consumption
Lead body: RDCK, Village

F10
Increase food preservation knowledge and practice
Lead body: KLAS, KFSP, Community

F11
Research best practice for crop farming e.g. techniques to mitigate variability and extreme weather events and changes in precipitation patterns
Lead body: KLAS, KFSP

F12
Monitor and communicate information on current financial agricultural incentives to aid transition
Lead body: BC Govt, MoA

In addition to the prioritised actions, the modelling and writing of the report provided the project with additional recommendations:

Action 1
According to information gathered via the questionnaire and at public meetings, gaining access to existing agricultural land access is a large and very real issue. For example, an owner of land inside the Agricultural Land Reserve may choose not to work the land for agricultural purposes, or may want to try to subdivide it for building purposes.

It is recommended that an Area wide ALR survey of land take place to establish the exact scale of this problem. It would be for the Agricultural Land Commission and the RDCK to then assess ways forward to maximize uptake of agricultural land for agricultural purposes. This will be addressed in the upcoming RDCK Area Agricultural Plan.

Action 2
It is vital to monitor the implementation of the recommended actions. This will ensure that the impetus created by this project is maintained and that communities within the area are given every opportunity to adapt to climate change. The Director of Area D has requested that the Area D Advisory Planning Commission carry out the monitoring of action implementation.

Appendix D - Steering committee members

John Addison, John Alton, Bob Dovey, Kaslo Mayor Greg Lay, Rhonda Ruston, Area D Director Andy Shadrack (Chair), Paul Sneed, Gail Spitler, Aimee Watson, Bill Wells, Michelle Laurie (CBT), Ramona Mattix (RDCK)

Members of CBT Technical Support Team:
Trevor Murdock (PCIC, UVic), Ingrid Liepa (PCIC liaison), Hans Schreier (UBC), Arelia Werner (PCIC UVic), Mel Reasoner, Martin Carver, Cindy Pearce, Jeff Zukiwsky

Appendix E - Acknowledgements

Acknowledgements

The Climate Change Adaptation & You project could not have happened without many hours of unpaid, volunteer time, in conjunction with financial support from Columbia Basin Trust, the Regional District of Central Kootenay and the Village of Kaslo. It is the drive for the long term health and wellbeing of this special area and the communities within it which has kept the project alive.

'Climate Change Adaptation & You' steering committee
Regional District of Central Kootenay
Village of Kaslo
Columbia Basin Trust
Kaslo Village Works Department
Columbia Basin Trust Technical Support Team
Gail Bauman (proof reading)
John Addison (Area maps and software expertise).

Contacts:
Regional District of Central Kootenay www.rdck.bc.ca, 1-800-268-7325
Kaslo Village www.kaslo.ca, (250) 353-2311
Columbia Basin Trust www.cbt.org, 1-800-505-8998
Pacific Climate Impacts Consortium www.pacificclimate.org, (250) 721-6236
Kaslo Food Security Project www.nklcss.org, (250) 353-7691
Kaslo & District Community Forest Society www.kaslocommunityforest.org, (250) 353-9677

Appendix F - Project Timeline

August 2009	RDCK/Kaslo village council commit to the project
November	Funding secured by RDCK and Kaslo to hire coordinator
December	Steering committee formed, Terms of Reference agreed
	PCIC engaged for climate data CBT TST engaged for stream/water modelling Selkirk College engaged for land use mapping and farming practice information
January 2010	Project Coordinator appointed
	Web site, information poster and briefings sheets designed
February	Project Mission Statement agreed TST area visit Initial feedback from TST climate and water modelling
March	Climate related impact charts assembled (Regional bee keeper representative and village public works manager in attendance). Climate data received from PCIC. Newsletter distributed
April	Public meetings and food grower meetings arranged
	Food grower questionnaire distributed
May	Climate related risks identified for risk assessment. Water modelling and land use/farming practice reports finalised
June	Risk Assessment undertaken. Preliminary adaptation actions identified
July	Adaptation actions prioritised Draft Project report published Project extension to Sept 30th '10
August onwards	Revised Project report published Newsletter written Final steering committee meeting Project report signed off Action recommendations signed off Public meeting planned (October)

Abbreviations:
CBT – Columbia Basin Trust
RDCK – Regional District of Central Kootenay
TST – Technical Support Team
PCIC – Pacific Climate Impacts Consortium

Appendix G - Project and Area Information

Project background

In 2009/10 Columbia Basin Trust continued its commitment to enable communities within the Columbia Basin to prepare climate change adaptation strategies, with joint funding of 3 projects to form Phase 2 of their 'Communities Adapting to Climate Change' initiative:

1. Kaslo/north Kootenay Lake, Lardeau and Duncan Valley areas (Area D) – *'Kaslo/Area D Climate Change & You'*
   www.rdck.bc.ca/adaptation
2. Castlegar
   'A sustainable Castlegar'
   http://castlegar.ca/sustainable
3. Rossland.
   'Vision to Action'
   http://www.visionstoaction.ca/

Castlegar
The City of Castlegar has identified municipal infrastructure as a key priority for climate change adaptation. Working in partnership with Engineers Canada, the City will conduct a vulnerability assessment for the storm water system to identify monitoring and management actions needed to ensure climate resiliency.

Because food security has been identified as a critical issue for the community, the City will also be exploring the resiliency of Castlegar's food system to climate changes, as well as establish a process to enable the community to identify a third impact area for further investigation. The City of Castlegar is also strategically exploring sustainability and will integrate climate change adaptation and mitigation into the concurrent Official Community Plan update.

Rossland
The City of Rossland's Sustainability Commission is focusing on climate change adaptation through a socio-economic lens to identify key vulnerabilities and opportunities for Rossland's local economy in the next forty years. Rossland has partnered with Simon Fraser University's Adapting to Climate Change Team

(ACT) to conduct research for their adaptation project. Rossland's local adaptation steering committee is working closely with all parties including the Sustainability Commission, to help guide the process.
The 9 month project in Kaslo/Area D was co-funded by Columbia Basin Trust (CBT) and the Regional District of Central Kootenay (RDCK) in order for a Climate Change Adaptation Strategy to be developed.

Phase 1 were climate adaptation projects in the East Kootenay communities of Elkord www.elkford.ca/ and Kimberley www.city.kimberley.bc.ca/

These projects run in conjunction with the CBT funded Kootenay Carbon Neutral Strategy and Corporate Emission Reduction projects.
The 9 month project in Kaslo/Area D was co-funded by Columbia Basin Trust (CBT) and, Regional District of Central Kootenay (RDCK) and Kaslo Village in order for a Climate Change Adaptation Strategy to be developed.

These projects preceded the Tri-regional district/CBT funded Kootenay Carbon Neutral Strategy which addresses Corporate Emission Reductions. Alongside the community projects is an adaptation learning network for Basin local governments and technical support members that come from across BC and beyond. Kaslo/RDCK took part.

Columbia Basin Trust (CBT) is committed to taking action on climate change and actively engaging with people living in the Columbia Basin. CBT will continue to act as convener and facilitator and support existing and emerging climate change initiatives as part of its long-term commitment to support people in the Columbia Basin to achieve social, economic and environmental well-being and self-sufficiency for present and future generations
(CBT website)

'Climate Change Adaptation & You' project is an extension of intent from the Kaslo OCP Policy area 17 'Energy and Climate Change', specifically
'The requirements of the Climate Change Adaptation Strategy are a necessary consideration of the Kaslo Integrated Community Sustainability Plan (ICSP).'
17.2.2, and follows a commitment to a greenhouse gas reduction target via a Sustainable Kaslo plan.

The Regional District of Central Kootenay's commitment to sustainability and sustainable communities is demonstrated by its current programs, outlined below.

Study Area
The study area was the northern part of Kootenay Lake, Lardeau and Duncan Valley areas in RDCK Area D, West Kootenay, BC.

Study approach
The co-funded CBT/RDCK/Kaslo project took the lead from its Steering Committee, and drew expertise from the CBT Technical Support Team, Selkirk College, Kaslo public works and the public. The Project Coordinator took responsibility for organizing the Steering Committee, all meetings, project research and the final report. Budget arrangements were looked after by the RDCK.

Kaslo/Area D information

Project Area (based on text from 'Regional District of Central Kootenay, Kootenay Lake, Lardeau and Duncan Valley portion of Electoral Area 'D' Official Community Plan bylaw no. 1996, 2009')

Historical Context
Most of the communities within the Plan area were settled during the mining boom of the 1880's and 1890's. Some were active mining communities, while others grew as saw mill and railroad communities or sternwheeler landing points to supply goods and services and pick up ore and produce. When the mining boom waned during the early 1900's some communities were abandoned, while others were promoted by the rail companies for fruit growing and resort development. Sternwheelers continued to be an important form of transportation to the area until 'The Moyie' was retired in 1957.
In 1965, construction started on the Duncan Dam, the first dam under the Columbia River Treaty. This resulted in some communities (Howser) being relocated as a result of changed water levels and diversion.

Communities in the area continued to be orientated toward the natural resource industry and the economic boom and bust cycles associated with such resource dependency. The isolated nature of the area ensured development pressure. Growth remained minimal and northern portions of the Plan area continued to receive Isolation Allowance up until the 1990's.

Recent trends in the area have shown an increase in amenity migration, or the movement of people into the area for its natural and recreational amenities. The increased ability of being able to work at a distance from places of employment (partly due to the internet), recreational home ownership, an aging and mobile population, and a more diversified economy have all resulted in specific types of development pressure in the area similar to most mountain communities within the Kootenay Rockies.

Geographic Context

Total population: Area D 1525, Kaslo 1073, total 2600
Land area: Area D 5,788.48 km², Kaslo 2.8km², total 5791.28 km², 26% of the Regional District of Central Kootenay.

Private households: Area D 710, Kaslo 480 (occupied) Total dwellings 1190

Regional District population: 56481
Area D/Kaslo share of Regional District population: 4.6%
Percent change '01-2006 Area D +1.7%, Kaslo +3.9%, Kaslo/Area D 2.6%

Statistics Canada 2006 census data (www.bcstats.gov.bc.ca)

The communities and residents of North Kootenay Lake, the Lardeau and Duncan Valleys have inevitably been influenced by the challenging geography of place. Situated in a narrow valley between the Purcell Range in the east and the Selkirk Range to the west, settlement has been confined to valley bottoms. Historically transportation goods and service routes have (other than by walking and pack trails), by necessity, been linear in nature and communities relied on the railways and sternwheelers. Today, these old rail lines and sternwheeler routes have been abandoned and replaced with Highway 31 along the western shore of Kootenay Lake and north to Trout Lake, and Highway 31A from the Village of Kaslo west to New Denver.

Residents and visitors must travel to the area as a destination and its relative isolation provides a challenge to economic diversification and sustainability. The natural environment has shaped the self-sufficient culture of many of the communities in the Plan area and is what attracts people to live and visit the area. The challenge of the physical environment, however, leaves many communities vulnerable to loss of services, the boom and bust economics of resource dependency, and isolation.

Growth in the area has historically been slow and followed the pattern of the economics of the region being tied to the natural resource industry. In 2006, the population of the area was estimated to be 2,600 persons residing in 1,473 dwellings according to census data. Part-time residency (potential holiday homes), based on non-resident property ownership, was approximately 19.3% that year. Increasingly, new development has been oriented toward recreational properties, while full-time residency has experienced resurgence due to an increased number of retirees, employment no longer being tied to location due to increased communications, and diversification toward tourism and recreational related employment. The attractiveness of the area, its isolation, and opportunities for a self sufficient lifestyle are some of many reasons that people reside here. It is an area where the physical geography of place still dominates and provides challenges to those who choose to make their home here. It is important to residents of the area, that the natural and cultural values that shape the area are maintained, while a strong and diversified economic future is developed.

While old orchards still exist, and there is interest in rural and self sufficient lifestyles including animal husbandry and gardens, commercial agriculture has declined. The attachment to the landscape and rural living is reflected in the community groups existing in the area. The vast majority rely solely upon volunteers and dollar donations. The biggest obstacle to expansion of commercial agriculture is the price of land and the inability of those who wish to farm to buy it.

Community and Population

The total population of Area D is 2,600 (2006 census data), representing a little over 2.7% of the Kootenay region population. Nearly 70% of the Area's population is centred around the village of Kaslo (1,072, 2006 census data), the remainder being distributed in settlements such as:
Howser, Meadow Creek, Cooper Creek, Argenta, Lardeau, Johnson's Landing, and Ainsworth.

The 2006 Kaslo census identifies the fact that 79% of the residential homes were constructed prior to 1986, with 11.5% in need of 'major' repairs. This should be considered when looking at adaptation to climate change with respect to funding the necessary changes, e.g. insulation, energy efficiency, water conservation, etc due to the varying condition of the housing stock and incomes.

The Village of Kaslo is working on a population growth of 2%, while the Regional District has a slightly lower figure of 1.5%.

Services Supplying Kaslo/Area D

Water

Due to the nature of development in the Plan area, much of the natural environment has remained un-fragmented and relatively intact in the higher reaches of mountain systems, while portions of the valley have been historically flooded or modified as part of the Columbia River Treaty. The conservation values of the Purcell Wilderness Conservancy, Goat Range and Kokanee Glacier Provincial Parks, and the multitude of smaller ecological sites and protected areas, contribute significantly to the local inventory of large natural space and the aesthetic qualities of the landscape. There are significant wildlife corridors and habitat values that have been identified as significant in the Plan area, as well as fisheries values in association with the lakes and larger river systems in the northern extent of the Plan area. This landscape has encouraged the development of many small water user systems.

Utility services in Kootenay Lake and the Lardeau Valley include the provision of water supplied by the Woodbury, Fletcher Creek, Mirror Lake, Pineridge, Schroeder Creek, Woodbury and Howser community water systems for domestic purposes. MacDonald Creek (Allen Division) is a Regional District service with water supplied by the Village of Kaslo, while Fletcher Creek is an Improvement District.

All other water systems in the Plan area are either privately or community owned and operated. Water supply and distribution in Kootenay Lake and the Lardeau Valley communities, including those with community water systems, primarily depend upon surface water and well water, with some obtaining water from Kootenay Lake (Woodbury and Pineridge) or Duncan Dam (Howser). Water systems and individual water sources are vulnerable to drinking water advisories, or over subscription of water resources. Areas that require water for both domestic and irrigation purposes can be especially vulnerable.

Only Kaslo has a publicly owned sewage service in the Plan area. Septic, and more recently, package sewage treatment plants, are the predominant form of sewage treatment. Refuse disposal for the area is provided at the regional transfer facilities west of the Village of Kaslo and at Marblehead north of Meadow Creek.

Access to and use of clean water is an essential component of a sustainable community. This remains a challenge for many users in Kaslo/Area D, especially when climate change is considered and how it will affect future provision. This project looked into how future climate change would impact the watersheds which supply the creeks from which the vast majority source their water.

Water users in Area D / Kaslo

Community	Approx numbers	Water type	Main water source	Water user group
Ainsworth	50	Only Hot Springs treated, rest untreated		
Kaslo/Allen subdivision	1100	Treated	Kemp Creek, Kaslo Reservoir (backup)	Kaslo village
Mirror Lake	100	Boil water advisory (BWA)	Bjerkness Creek	Mirror Lake water users group

Kaslo south/Pine ridge	50	Individual, no treatment	Wells Lofstedt Creek,	Kaslo south area water society
Pine Ridge	50	Treated	Kootenay Lake	Pine Ridge Comm.
Fletcher Creek	50	BWA	Fletcher Creek	Fletcher Creek community
Woodbury Village		Treated	Kootenay Lake, Woodbury Creek	Woodbury Village community
Shutty Bench	100	Individual, no treatment	Wells Kootenay lake, various	
Schroeder Point	50	Treated	Schroeder Creek	
Lardeau	100	Well untreated	Davis Creek	Lardeau Water Users Group
Meadow Creek		Individual no treatment	Wells Meadow Creek	
Howser	10	Individual no treatment	Duncan Lake	
Boyd/Hamill Creek		Individual no treatment	Hamill Creek Wells	
Argenta		Individual no treatment	Argenta Creek, Carter Creek,	
Bulmers Pointe		Treated	Bulmers Creek	
Johnson's Landing		Individual no treatment	Kootenay Joe Ck, Gardener Ck, Gar Ck, 1 well	

Electricity
All the electricity in Kaslo/Area D is provided by FortisBC, including a contract with BC Hydro for the Lardeau Valley , there being a few properties, particularly in the north of the area off the grid, relying on power generation by alternative methods (pelton wheel, solar/diesel). The power lines mainly follow the main road routes and are constantly under threat of damage from weather related events, e.g. windthrow, snow.

BC Hydro's electrical system in the province consists of nearly 75,000 km of transmission and distribution lines. Much of this infrastructure, covering 94% of the province, is located in mountainous and tree-covered terrain, making it

vulnerable and subject to both natural and human impacts. Storms cause outages through wind, ice and snow and through tree branches contacting lines. As a result, a change in the frequency of extreme weather events will affect power reliability.
Jennifer Walker-Larsen, Stakeholder Engagement Advisor, BC Hydro

Fortis BC has undertaken a substantial supply line upgrade and do not presently incorporate any climate adaptation planning into their strategic long term thinking *(phone conversation with Barry Smithson, Director of Network Operations, Fortis BC).*

Roads
Access to Kaslo/Area D is mainly from the south along Highway 31 (Nelson). Most services which require road transport access the area this way. The access from the north from Howser/Lardeau is gravel. Highway 31A from the west (New Denver/Slocan Valley) is a mountain pass.

Several areas are identified as slide hazard and non-stand flooding and erosional areas, which make road access vulnerable to rock, mud and snow slides. Road closures are not uncommon, affecting emergency access and food supply. Highway 31, north of Kaslo, is used for commercial transport of commercial logs and wood products from Copper Creek and Meadow Creek and logging in the Lardeau and Duncan Valleys and to access recreational fishing, hunting, camping, skiing, 4x4 vehicles, snowmobiling and mountain climbing.

There is one major RDCK-identified slide hazard area before and at Ainsworth Hot Springs, with numerous identified flooding and erosional areas along the north/south Highway 31 corridor and the east/west Highway 31A pass. During the winter, slides are commonplace and can also occur during extreme weather conditions, e.g. rainstorms. These known hazards, coupled with power lines following similar routes, mean that the area as a whole is at risk at any time of any number of natural hazards. Anecdotal evidence has provided the following information as regards to areas at risk of landslides/flooding

Slides that have closed the highway or took out power:

- Lardeau bluffs (annually, usually snow avalanches)
- Lost Ledge Creek (debris flow) ~2000
- Shutty Bench, south end (perennial slide across the highway, portion of road taken out ~2005)
- Several slide chutes along 31A between Kaslo and New Denver (usually snow avalanches)
- Perennial slide at Whitewater Creek
- Coffee Creek Bluffs and Ainsworth - Coffee Creek power line (snowlslides and mudslides).

Floods that closed the highway or took out power:

- Meadow Creek area - Meadow Creek overflows the channel along the highway. Most years, some private properties are flooded.
- Hamill Creek ~2000. Forest Service road bridge blown out; private properties eroded.
- McDonald Creek (upper Kaslo), most recently in early 2000's, took out Hwy 31 - emergency program involved. It destroyed the collection infrastructure so Allen Subdivision is now on the Kaslo Water system.
- The area near Woodbury-Fletcher Creek Forest road, just south of Fletcher Creek
- Ainsworth, Coffee Creek

Appendix H - Climate data

Climate change projections

Even the climate sceptics agree the planet's climate is changing. Anecdotal evidence and scientific research both lead to the same conclusion. There is also widespread scientific consensus that our changing climate is caused largely by greenhouse gas emissions from the burning of fossil fuels. The momentum to act on climate change is evident in communities the world over.

'A strong, credible body of scientific evidence shows that climate change is occurring, is caused largely by human activities, and poses significant risks for a broad range of human and natural systems.'
'America's Climate Choices' National Research Council of the National Academies report brief www.americasclimatechoices.org

As such, global ecosystems and the life support they provide (eg food, water) are at considerable risk. Governments and individuals the world over are now having to make choices:

1. slow down or reverse climate change (mitigation)
2. action to deal with the consequences of a changing climate (adaptation)

The mitigation of climate change is geared towards global actions by governments or major private sector operators. For example the BC province has targeted a 33% reduction by 2050.

Adaptation is more often than not initiated at a local community or regional level. However, there is large scope for crossover between mitigation and adaptation, local initiatives manifesting themselves towards global change (eg Nelson Transition Town, Kaslo Food Security Project, Nelson Car-Share program, Kootenay Ride Share, Kootenay Savings Credit Union). These often have impacts beyond simply climate change, encouraging a shift in social, economic and political structure, i.e. lifestyle.

Adaptation actions can have (often unintended) a positive or negative mitigation effect

An example of an adaptation action with a negative mitigation effect is the growing of a new warmer climate resistant crop, but requires more water than the ones previously grown, thus increasing the gap between the 'needed' and available water.
An example of an adaptation action with a positive mitigation effect is the installation of low flush toilets. Using these will reduce the amount of water used as well as lower the amount of energy consumed to pump and treat the water.

Mitigation actions can have (also often unintended) positive or negative adaptation effects.
An example of a mitigation action with a positive adaptation effect could be the afforestation of degraded hill slopes, which would not only sequester carbon but also control soil erosion.
An example of a mitigation action with negative adaptation effects could be building biking/walking trails to promote less vehicle use with, stream crossings that aren't high/wide enough to handle more frequent high flows with extreme weather events

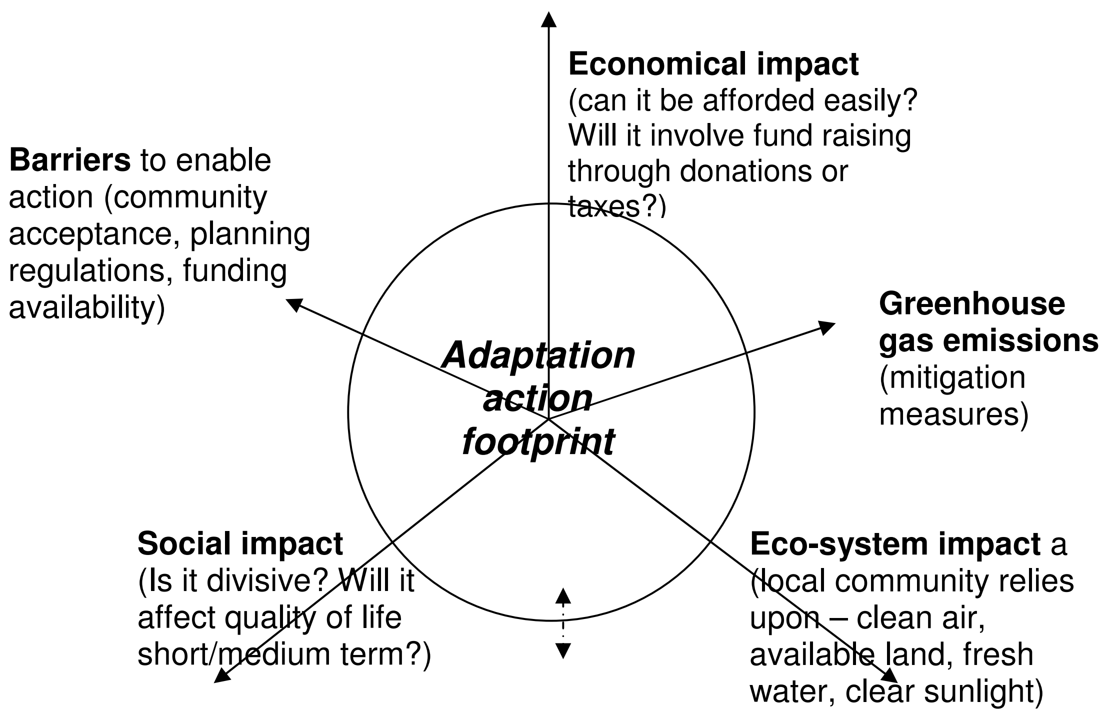


Figure 1. Adaptation action Footprint

A good adaptation action with many desirable attributes would result in a smaller footprint.

e.g. Herb Thompon, Kaslo resident, installed a 1000 gallon rainwater tank for garden irrigation to reduce the consumption of treated water.

A risky or unpopular adaptation action would result in a larger footprint, with corresponding negative impacts socially, environmentally and economically, e.g. a new reservoir construction to provide more water storage could prove very costly, be unpopular, use a substantial amount of raw materials and high environmental impact

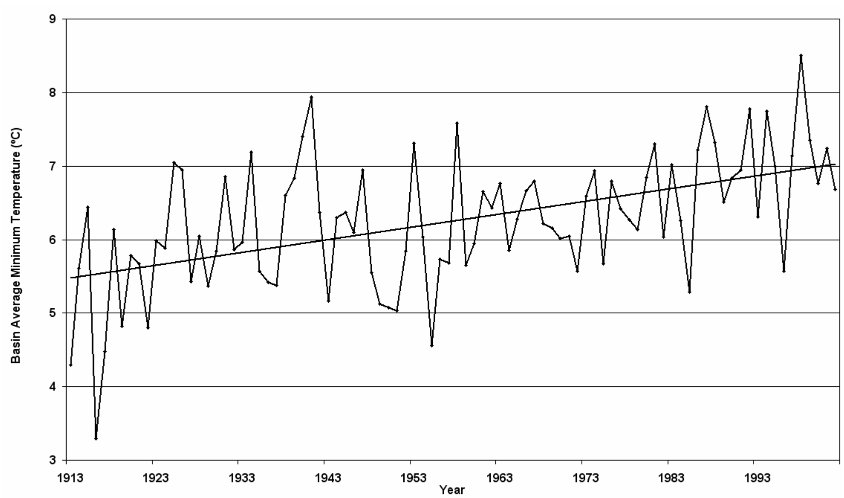
The aim would be to have as small a footprint as possible. Often, mitigation and adaptation actions cross over to compliment or counter the other. This must be considered when a community decides upon a course of adaptive actions, ideally agreeing upon a series of adaptation measures which progress mitigation of greenhouse gases, or simply promote healthy communities and lifestyles.

Basin Climate Trends – 1913 to 2002

(Murdock & Werner 2010)

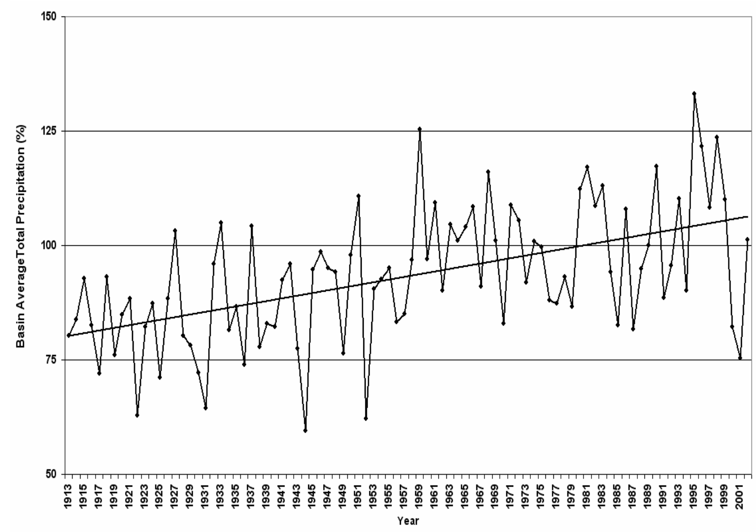
Mean Annual Temperature

+1.5 °C



Mean Annual Precipitation

+32% rainfall; -6% snowfall



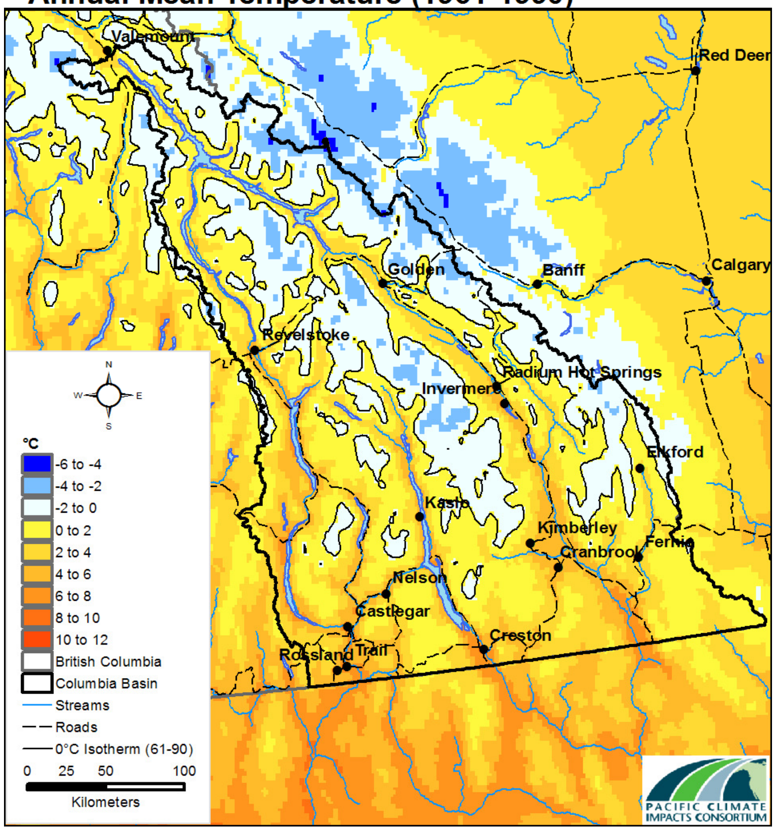
Note: ***Data from Cranbrook, Golden, Creston, Kaslo, Revelstoke.***

Kaslo trends: temperature = +1.3°C, rainfall = +44%, snowfall = +5%

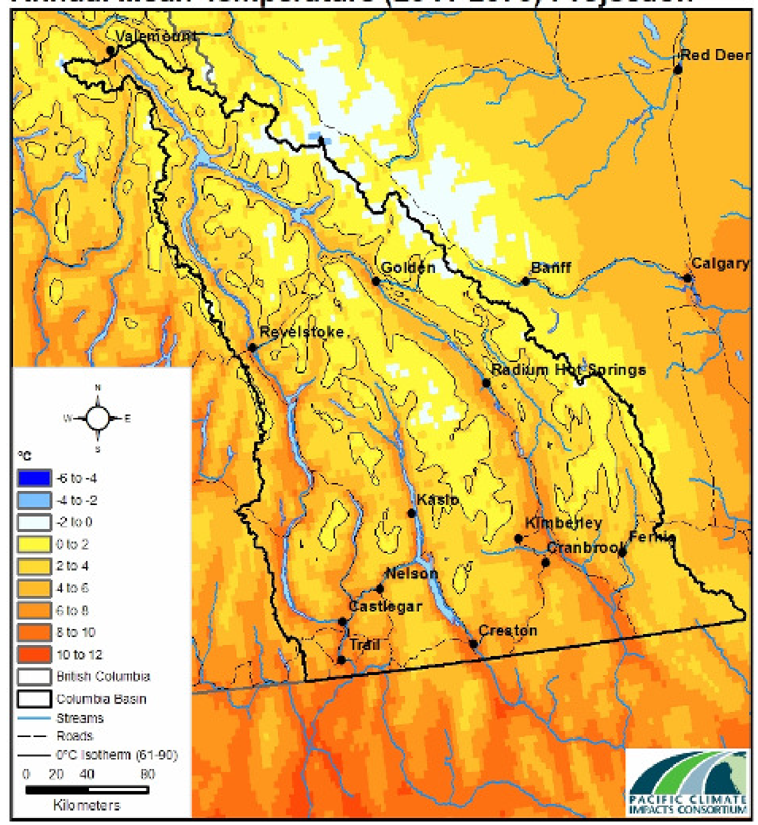
Temperature: Past and Future

(Murdock & Werner 2010)

Annual Mean Temperature (1961-1990)



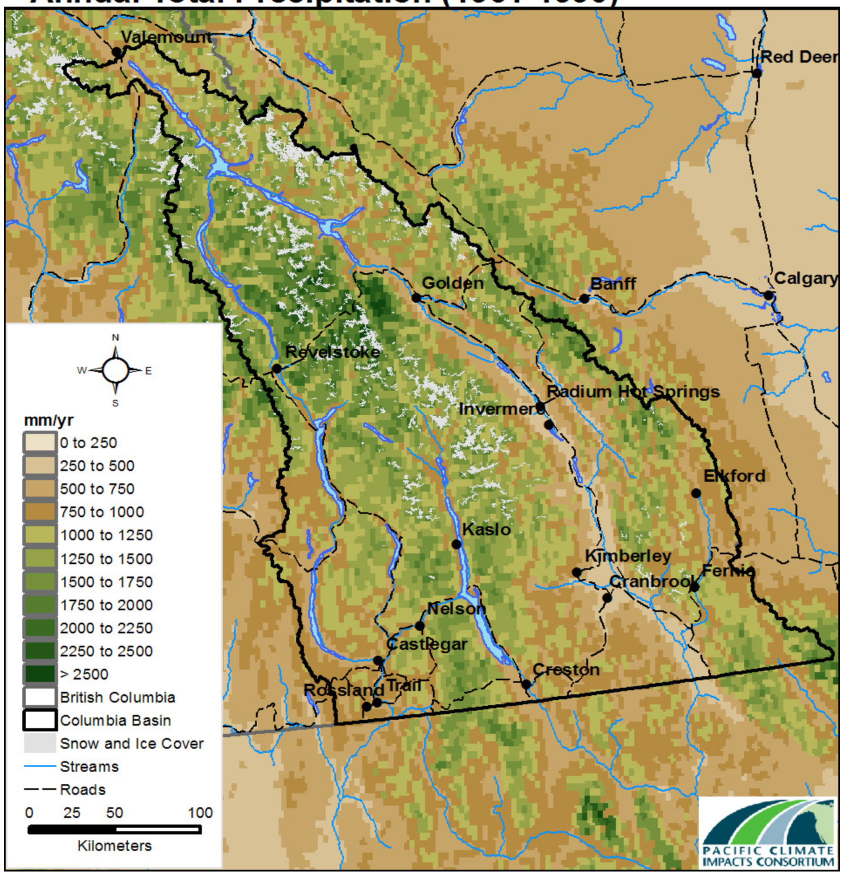
Annual Mean Temperature (2041-2070) Projection



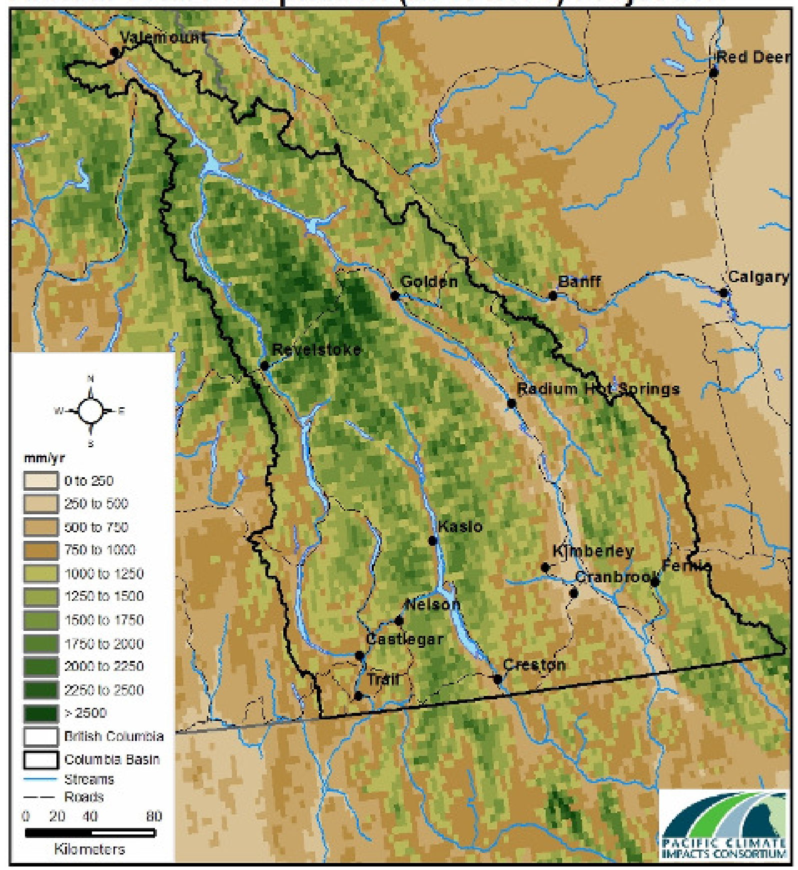
Precipitation – Past and Future

(Murdock & Werner 2010)

Annual Total Precipitation (1961-1990)



Annual Total Precipitation (2041-2070) Projection

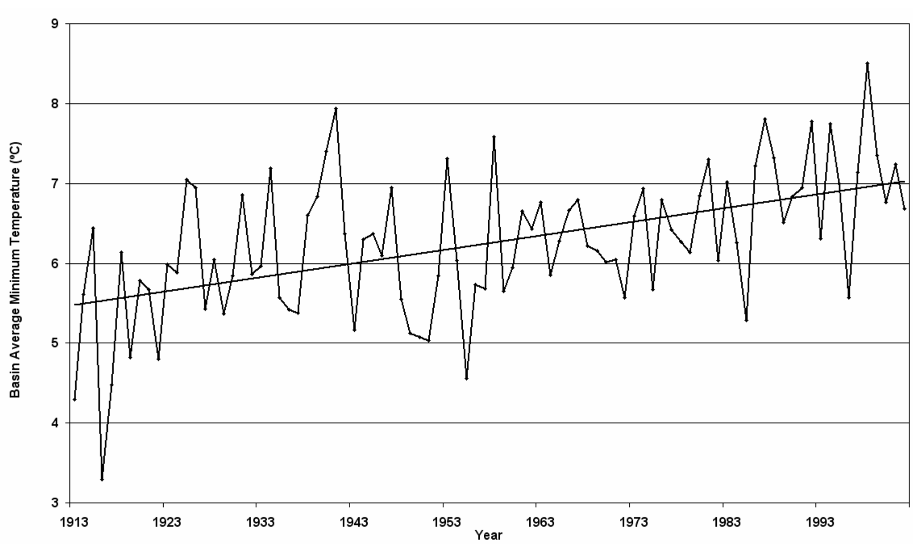


Basin Climate Trends – 1913 to 2002

(Murdock & Werner 2010)

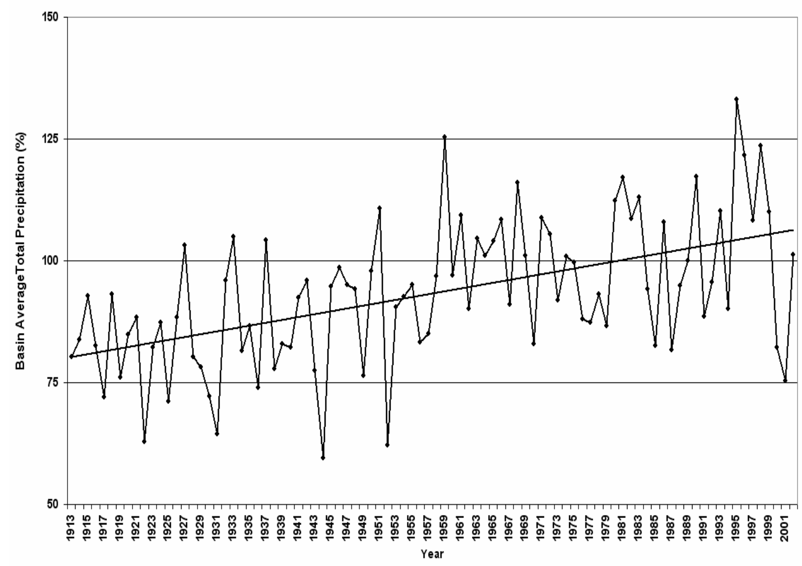
Mean Annual Temperature

+1.5 °C



Mean Annual Precipitation

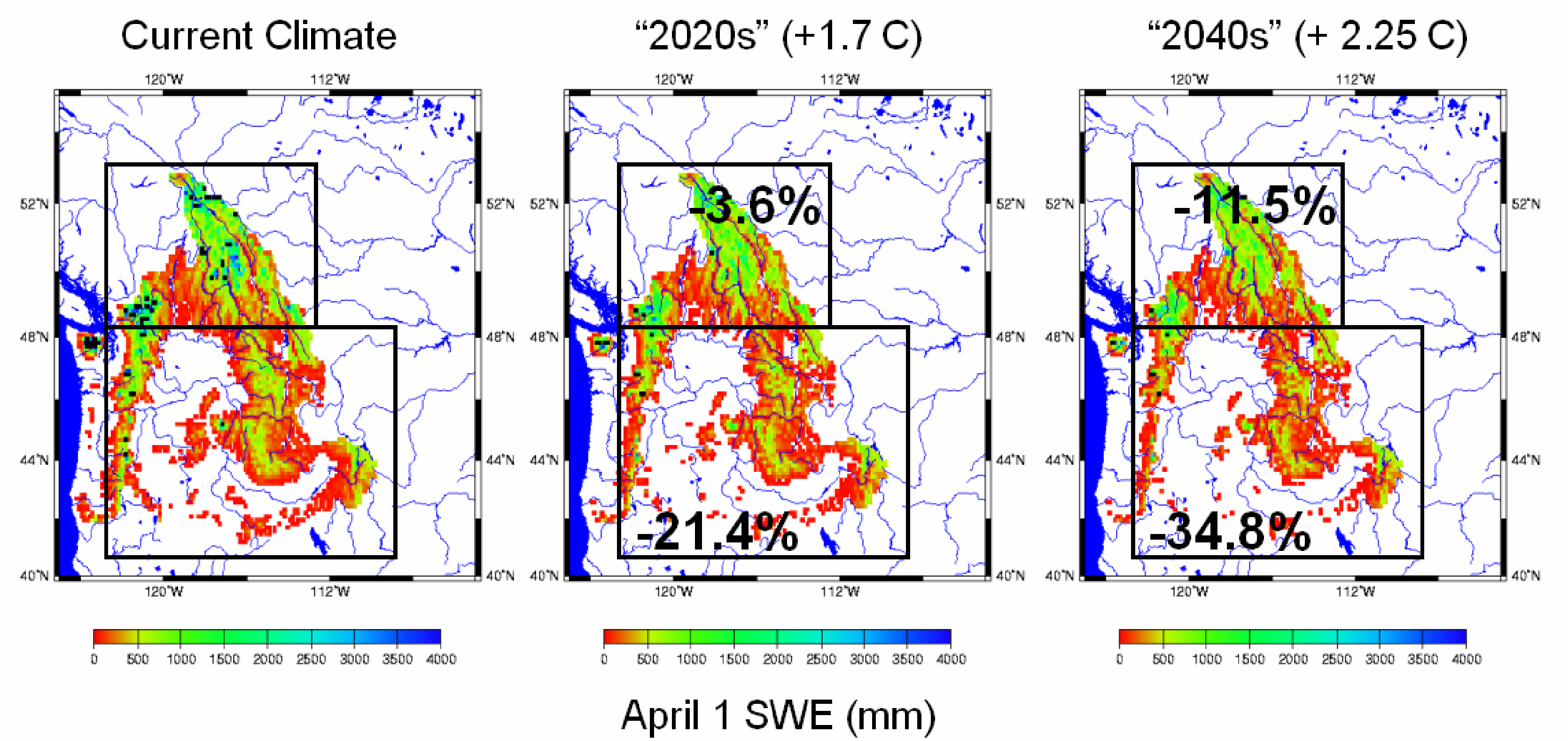
+32% rainfall; -6% snowfall



Note: ***Data from Cranbrook, Golden, Creston, Kaslo, Revelstoke.***

Kaslo trends: temperature = +1.3°C, rainfall = +44%, snowfall = +5%

Columbia Basin April 1 Snowpack: projected decreases

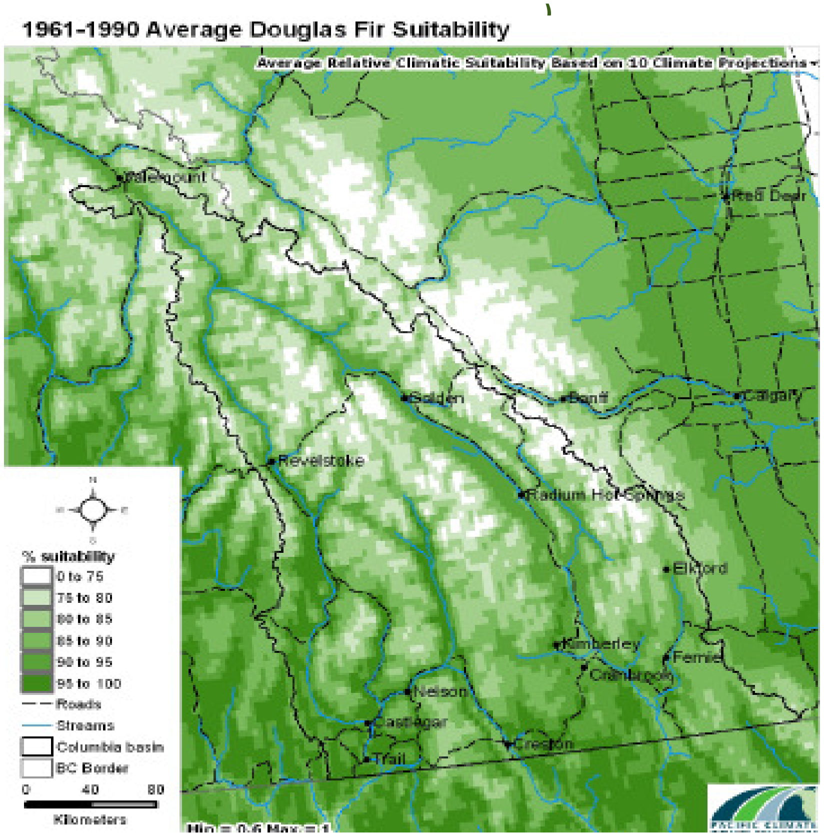


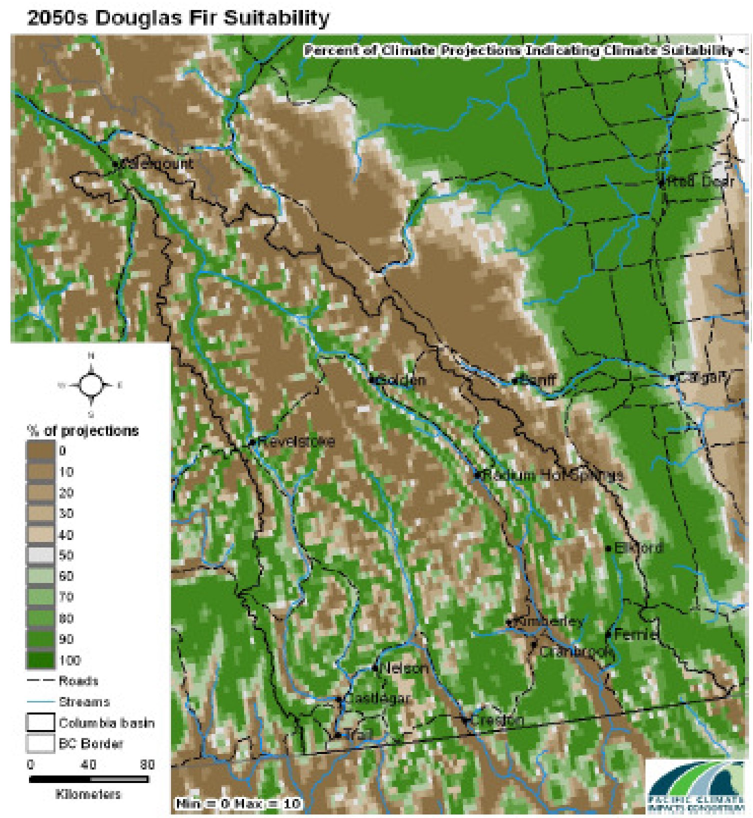
Source: Climate Impacts Group, University of Washington (Mote et al., 2005)

Potential Suitability: Douglas Fir – Past and Future

(Murdock & Werner 2010)

(% agreement, based on 10 projections)

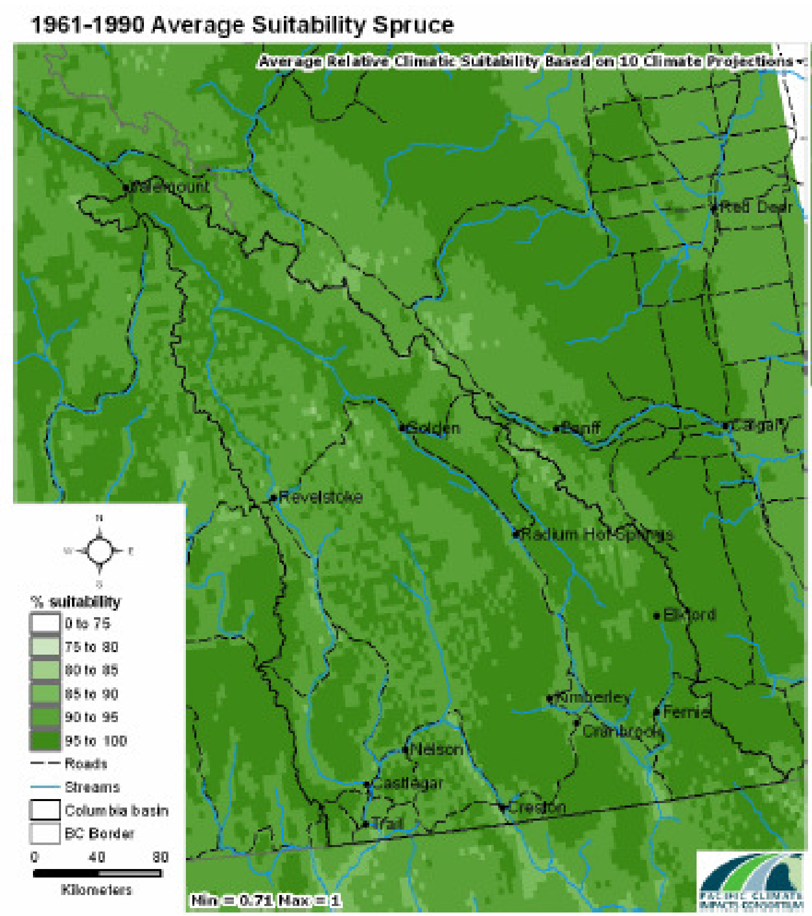


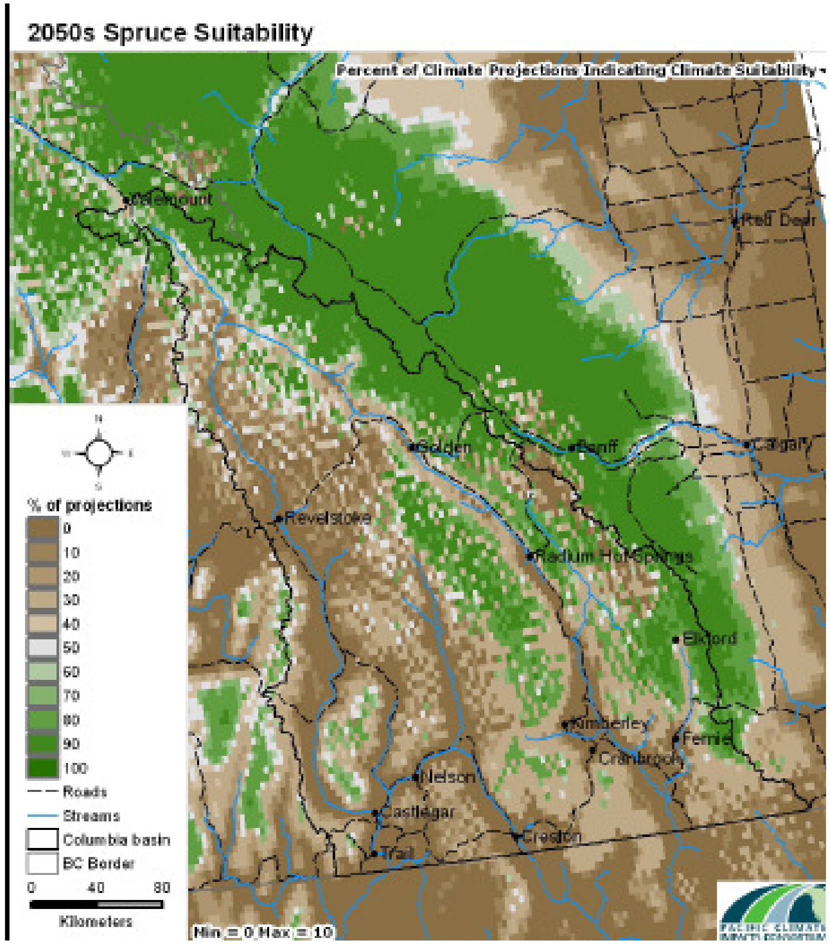


Potential Suitability: Engelmann & White Spruce – Past and Future

(Murdock & Werner 2010)

(% agreement, based on 10 projections)





Reference: Murdock, T.Q., and A.T. Werner, 2010: Updated Past Trends and Future Projections for the Canadian Columbia Basin: 2010, Pacific Climate Impacts Consortium, University of Victoria, Victoria BC, 52 pp.

CLIMATE DATA FOR CENTRAL KOOTENAY

(INCLUDING KASLO/AREA "D")

Climate change figures from www.Plan2Adapt.ca

Baseline figures: 1961 – 1990. (Source: Environment Canada statistics)
Baseline Growing Degree Days: 1700 (point Kaslo)

ANNUAL TEMPERATURE (°C)	2020s	**2050s**	2080s
90th percentile	1.4	**2.8**	4.4
Median	1.0	**1.9**	2.8
10th percentile	0.7	**1.2**	1.8

ANNUAL PRECIPITATION (%)	2020s	**2050s**	2080s
90th percentile	7	**9**	11
Median	4	**5**	6
10th percentile	0	**-2**	2

ANNUAL FROST-FREE DAYS	2020s	**2050s**	2080s
90th percentile	21	**36**	61
Median	13	**25**	38
10th percentile	8	**16**	22

Baseline 1971-1990 197 FFD
Awaiting figures for extreme drought and extreme rainfall

PROJECTIONS FOR SPRING (March, April, May)

SPRING: TEMPERATURES (+°C)	**2020s**	**2050s**	**2080s**
90th percentile	1.4	**2.5**	4.2
Median	0.8	**1.4**	2.3
10th percentile	0.3	**0.9**	1.1

1961-1990 average **7°C**

* Temperature refers to the average of the nighttime low (minimum temperature) and the daytime high (maximum temperature).

SPRING: PRECIPITATION (%)	2020s	2050s	2080s
90th percentile	14	**21**	22
Median	6	**8**	14
10th percentile	-0.5	**4**	5

1961-1990 average **53.5mm**

* Precipitation (rain plus snow) refers to the total amount of water that results from rainfall plus the amount of water that would result from melting of fallen snow.

SPRING: SNOWFALL (%)	2020s	2050s	2080s
90th percentile	-1	**-14**	-17
Median	-27	**-54**	-74
10th percentile	-52	**-73**	-88

1961-1990 average **4.2cm**

* 'Precipitation as Snow' is a derived variable, calculated from GCM projected total precipitation (rain and snow) as well as temperature.

SPRING: GROWING DEGREE DAYS	2020s	2050s	2080s
90th percentile	276	**513**	978
Median	177	**367**	548
10th percentile	87	**219**	347

1961-1990 average **90.3 GDD**

* Growing Degree Days (GDDs) is a derived variable that indicates the amount of heat energy available for plant growth, useful for determining the growth potential of crops in a given area. It is calculated by multiplying the number of days that the mean daily temperature exceeded 5℃ by the number of degrees above that threshold. For example, if a given day saw an average temperature of 8℃ (3℃ above the 5℃ threshold), that day contributed 3 GDDs to the total. If a month had 15 such days, and the rest of the days had mean temperatures below the 5℃ threshold, that month would result in 45 GDDs.

SPRING: FROST FREE DAYS	2020s	2050s	2080s
90th percentile	21	**36**	61
Median	13	**25**	38
10th percentile	8	**16**	22

* Frost-free days is a derived variable referring to the number of days that the minimum daily temperature stayed above 0℃, useful for determining the suitability of growing certain crops in a given area.

PROJECTIONS FOR SUMMER (June, July, August)

SUMMER: TEMPERATURE (+℃)	**2020s**	**2050s**	**2080s**
90th percentile	1.8	**3.3**	6.0
Median	1.3	**2.4**	3.6
10th percentile	0.8	**1.6**	2.2

1961-1990 average **17.1℃**

SUMMER: PRECIPITATION (%)	**2020s**	**2050s**	**2080s**
90th percentile	6	**-2**	1
Median	-5	**-10**	-13
10th percentile	-12	**-20**	-30

1961-1990 average **55.9mm**

SUMMER: GROWING DEGREE DAYS	**2020s**	**2050s**	**2080s**
90th percentile	156	**297**	539
Median	112	**214**	323
10th percentile	62	**142**	189

1961-1990 average **370.8 GGD**

SUMMER: FROST FREE DAYS	**2020s**	**2050s**	**2080s**
90th percentile	2	**3**	4
Median	2	**3**	3
10th percentile	1	**2**	3

PROJECTIONS FOR FALL (August, September, October)

FALL: TEMPERATURE (+℃)	**2020s**	**2050s**	**2080s**
90th percentile	1.4	**2.6**	4.4
Median	1.1	**1.8**	3.1
10th percentile	0.7	**1.1**	1.8

1961-1990 average **7.2℃**

FALL: PRECIPITATION (%)	**2020s**	**2050s**	**2080s**
90th percentile	11	**17**	19
Median	4	**9**	10
10th percentile	-2	**-1**	0.5

1961-1990 average **65.0mm** (but skewed because of wet Novembers)

FALL: SNOWFALL (%)	**2020s**	**2050s**	**2080s**
90th percentile	1	-1	-7
Median	-6	-14	-23
10th percentile	-15	-23	-40

1961-1990 average **8.3cm** (but skewed because of wet Novembers)

FALL: GROWING DEGREE DAYS	**2020s**	**2050s**	**2080s**
90th percentile	4	**22**	78
Median	2	**9**	29
10th percentile	0	**3**	6

1961-1990 average **106.4 GGD**

PROJECTIONS FOR WINTER (November, December, January)

WINTER: TEMPERATURE (+°C)	**2020s**	**2050s**	**2080s**
90th percentile	1.7	**3.3**	4.8
Median	1.0	**1.7**	2.7
10th percentile	0.3	**0.9**	1.4

1961-1990 average **-2.0°C**

WINTER: PRECIPITATION (%)	**2020s**	**2050s**	**2080s**
90th percentile	11	**17**	24
Median	4	**7**	14
10th percentile	-2	**-2**	2

1961-1990 average **101.4mm**

WINTER: SNOWFALL (%)	**2020s**	**2050s**	**2080s**
90th percentile	3	**2**	-4
Median	-4	**-11**	-16
10th percentile	-13	**-18**	-35

1961-1990 average **62.5cm**

WINTER:			
FROST FREE DAYS	**2020s**	**2050s**	**2080s**
90th percentile	5	**11**	22
Median	3	**5**	9
10th percentile	1	**2**	4

Climate

1. Multiple projections information is drawn from a set of 30 GCM projections based on results from 15 different Global Climate Models (GCMs), each using one run of a high (A2) and a lower (B1) greenhouse gas emissions scenario. By the end of the 21st century, these scenarios anticipate an atmospheric concentration of greenhouse gases of approximately 1250 ppm (A2) and 600 ppm (B1), expressed as carbon dioxide (CO2) equivalent. Neither scenario incorporates the effects of international agreements on the reduction of greenhouse gas emissions, though other socio-economic factors like population growth are modelled. Each GCM comes from a different modelling centre (e.g. the Hadley Centre (UK), National Centre for Atmospheric Research (USA), Geophysical Fluid Dynamics Laboratory (USA), and Commonwealth Scientific and Industrial Research Organisation (Australia), etc.).
2. The single projection used for the maps is the CGCM3 A2 run 4. CGCM3 is the Canadian Global Climate Model, developed and run by Environment Canada's Canadian Centre for Climate Modeling and Analysis at the University of Victoria. The A2 specification denotes a possible future where emissions continue to rise alongside increases in human population and economic growth. A2 is one emissions scenario amongst several developed by the Intergovernmental Panel on Climate Change (IPCC) and published in its Special Report on Emissions Scenarios (SRES) (see 'References' tab).
3. High-resolution climate data is obtained by using the ClimateBC empirical downscaling tool. ClimateBC uses interpolation, an elevation correction on temperature, and the PRISM (Parameter-elevation Regressions on Independent Slopes Model) 4 km high-resolution climatology derived from a multiple regression of weather station data against topographical features. This projected change from Global Climate Models (GCMs) is applied to the high resolution past in order to obtain an estimate of future climate at the same high resolution.
4. The 2020s, 2050s, and 2080s time periods are meant to be used as three representative planning horizons over the 21st century. Results for these three planning horizons are computed by averaging GCM projections over the 2010-2039, 2040-2069, and 2070-2099 periods, respectively.