Protecting the Logging Workforce: Development of Innovative Logging Techniques for a Safer Working Environment

The Team

Kevin Boston[1], Woodam Chung[1], Tamara Cushing[1], John Garland[3], Laurel Kincl[2], Ben Leshchinsky[1], John Sessions[1], and Jeff Wimer[1]

Of

1 - College of Forestry

2- Public Heath and Human Sciences

3- Garland and Associates

Outline

- Review the reason for the proposal.
- Describe the three-year project.
- Describe our known gaps in the project.
- Future work in the project.

The problem: Demographic

In a 2008 Wood Supply industry Report:

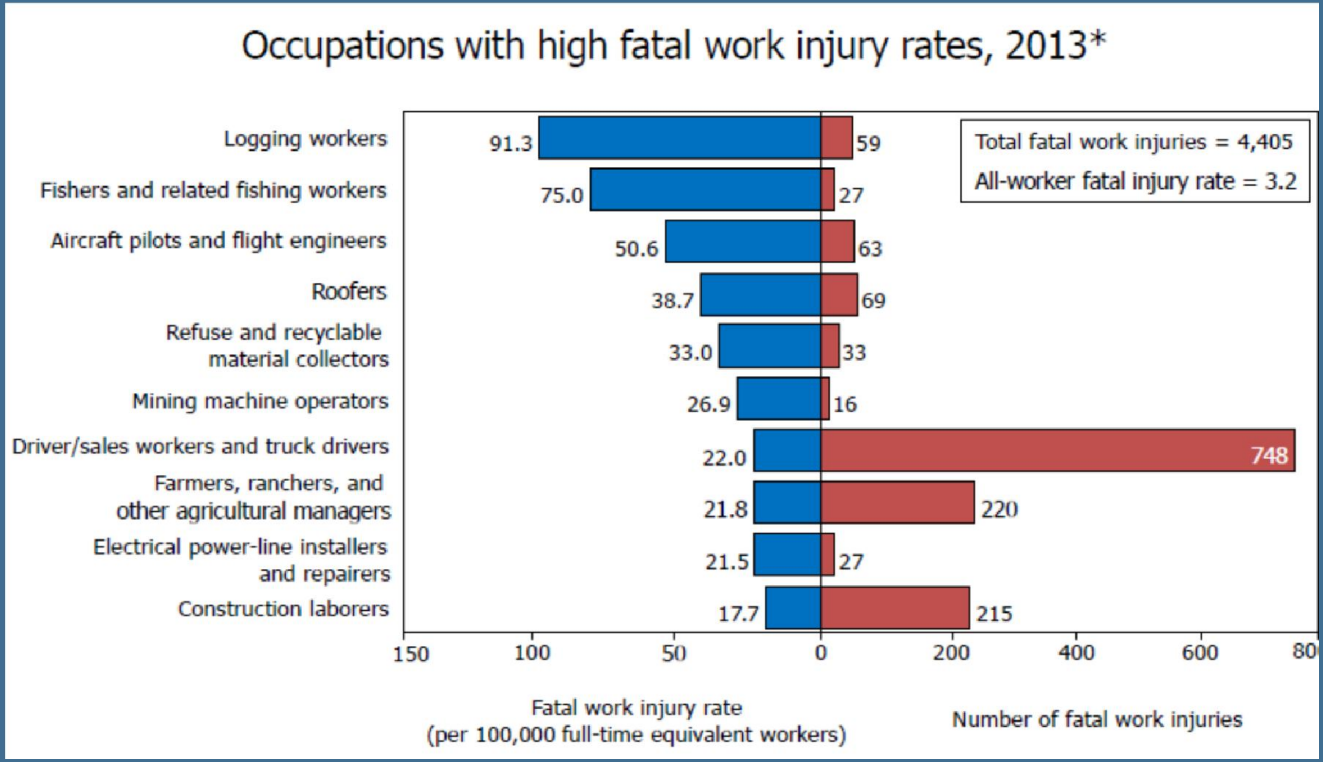
Workforce:

Over 50% of the firms are held by people over 51 years of age with average age of the workforce in the mid 40's.

Succession planning:

Almost 40% of the logging firms have no successional planning for the next generation of business.

The problem: Accident Rate



Injury rate by task

- Timber falling – 34% of fatalities are struck by accidents.
- Choker Setting – 29% of fatalities are struck by moving log or rolling logs.

The Problem:

John Garland has used the 4 D's to characterize the logging job:

1. Difficult
2. Dirty
3. Dangerous
3. Declining

Questions

- Who is going to do this work in the future?
- Can the logging system be redesigned to accommodate a shrinking and aging logging force to reduce the accident rate?

Our proposal

- We proposed this basic question to the Occupational Safety and Health Program under the Center and Disease Control and Prevention in the Department of Health and Human Services. Total award is approximately $825,000.
- It is a research-to practice approach that combines engineering analysis with human-factors studies to take a full-system prospective on improving the safety of the logging operation. Four specific aims are:
  (1) demonstration of new mechanized logging systems with industry cooperators;
  (2) assessment of practical and physiological response of workers during operation;
  (3) develop design guidelines and criteria for new logging systems; and
  (4) deliver outreach and educational components to people in the logging occupation.

We are not alone:

- There are ongoing studies in central Europe
- Much of the new equipment, especially track equipment, is being developed in New Zealand.
- Scion in New Zealand has ongoing research projects
- Future Forests in New Zealand is funding ongoing research projects
- FPInnovation of Canada has approximately $5 million in research projects.

- We have all agreed in to share protocols, concepts and ideas and have a quarterly conference call. We are talking about sharing the limited resources to maximize the accumulation of knowledge about these.

Overview:

When the study is completed, we will have:

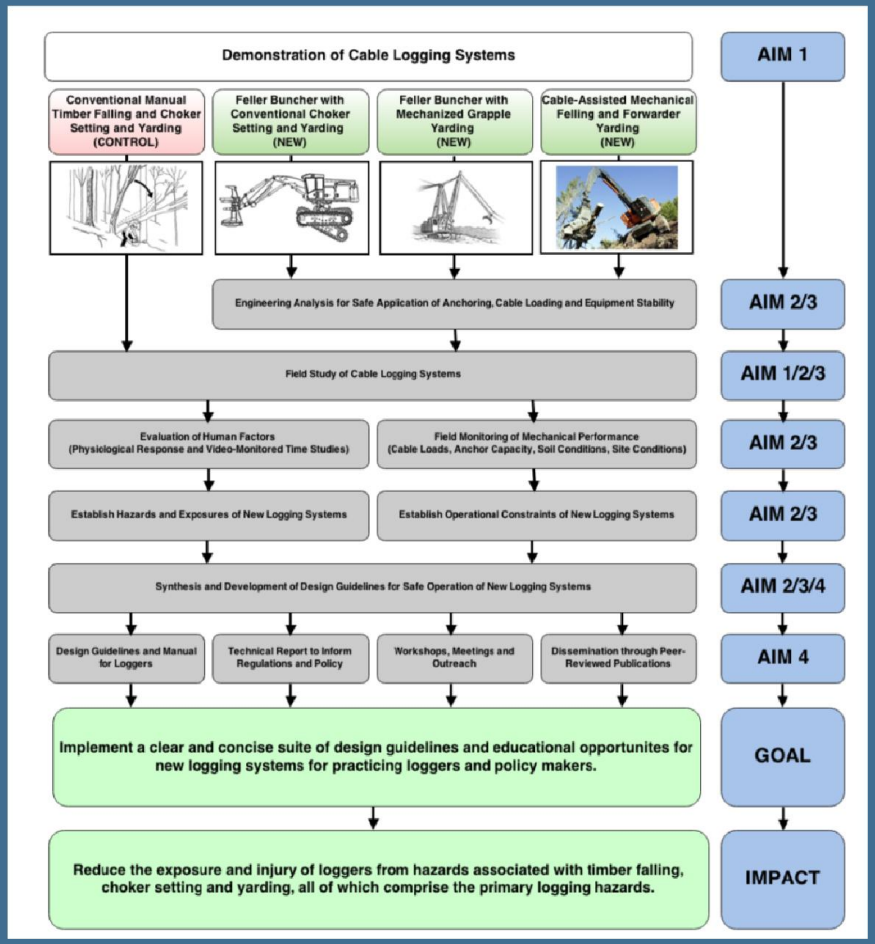
(1) evaluated the benefits of mechanical felling and bunching on safe operation,

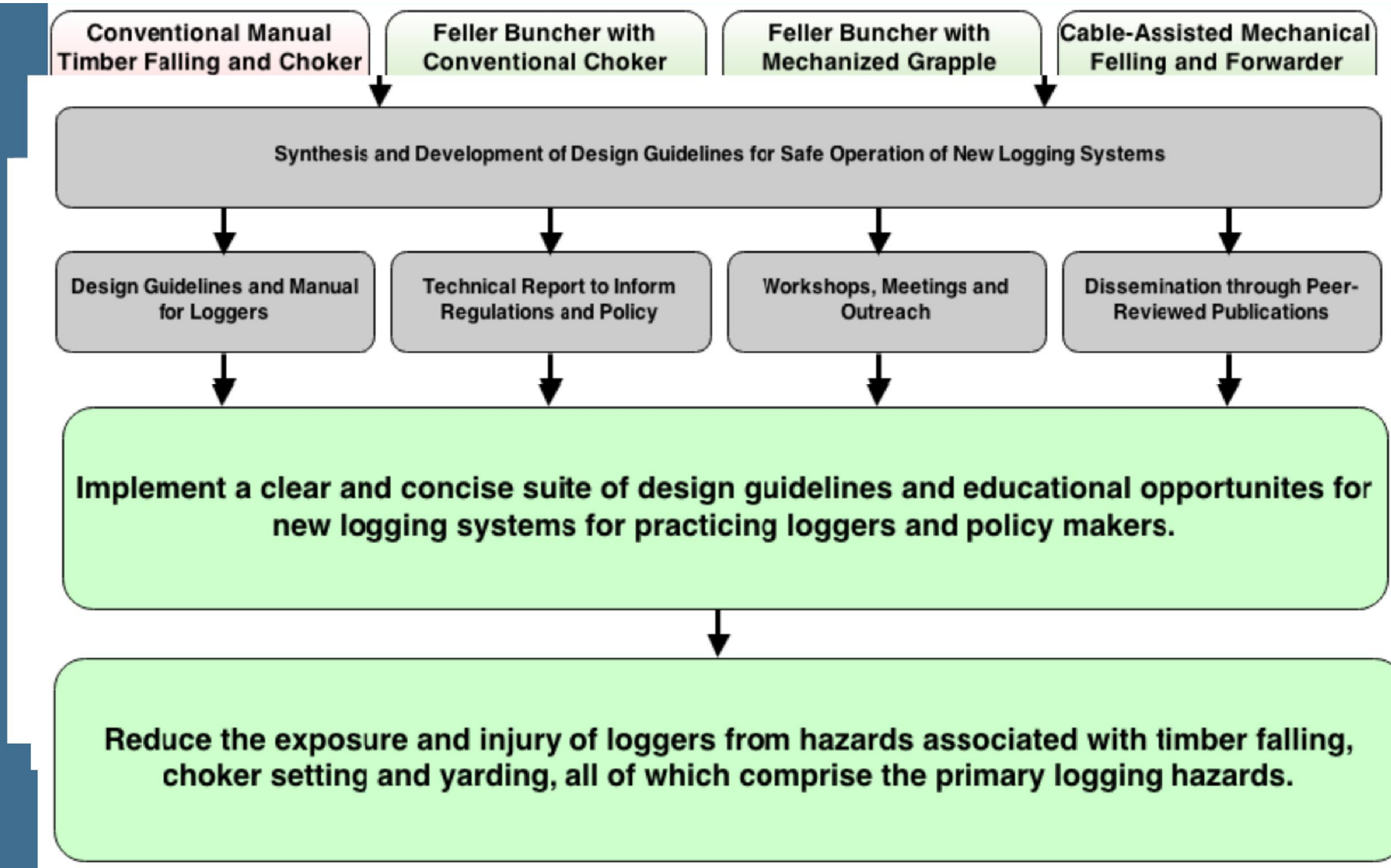
(2) extended the applications of grapple yarding and cable-assisted vehicles to reduce exposure to hazards,

(3) documented the improved safety of the new systems using a variety of quantitative techniques, and

(4) developed multi-media outreach programs to support the adoption of the improved safety techniques developed in this study.

Project Description




Conventional Manual Timber Falling and Choker
Feller Buncher with Conventional Choker
Feller Buncher with Mechanized Grapple
Cable-Assisted Mechanical Felling and Forwarder
Synthesis and Development of Design Guidelines for Safe Operation of New Logging Systems
Design Guidelines and Manual for Loggers
Technical Report to Inform Regulations and Policy
Workshops, Meetings and Outreach
Dissemination through Peer-Reviewed Publications
Implement a clear and concise suite of design guidelines and educational opportunites for new logging systems for practicing loggers and policy makers.
Reduce the exposure and injury of loggers from hazards associated with timber falling, choker setting and yarding, all of which comprise the primary logging hazards.

First year – tethered or cable assist logging

- These can be grouped into a variety of categories:
  - Wheeled
  - Track

  Or
  - Dynamic
  - Static lines

Static lines

Dynamic Lines winch is on-board

All of the track machines have tall grousers

Our trials

Experiments:

- Field stability trials to measure the soil pressure changes and accelerometers to measure changes in the machine under various loading.
- Field traction trials – what is the impact of soil strength and slope on the ability to have the machine climb a hill. It will measure soil pressure under the tracks, machine and operator acceleration, and cable tensions for the tethered machines.

Samples from existing operations:

- Finally, we will monitor ongoing operations that will include operator and machine information on the performance of the logging system.

The research

- There are significant developments in technology that are allowing us to do this study in a different manner.
  - Low cost digital cameras
  - Ground pressure sensors
  - Accelerometer
  - Eye tracking devices
  - Pulse and skin temperature measuring devices.

Equipment – low cost digital cameras

- GoPro digital cameras
  - Allow for production studies
  - Allow for recording of hazards and operator responses

Equipment – Pressure Cells

- This will allow us to measure the pressure below the tracks:
  - Stability calculation
  - Soil compaction and site impacts

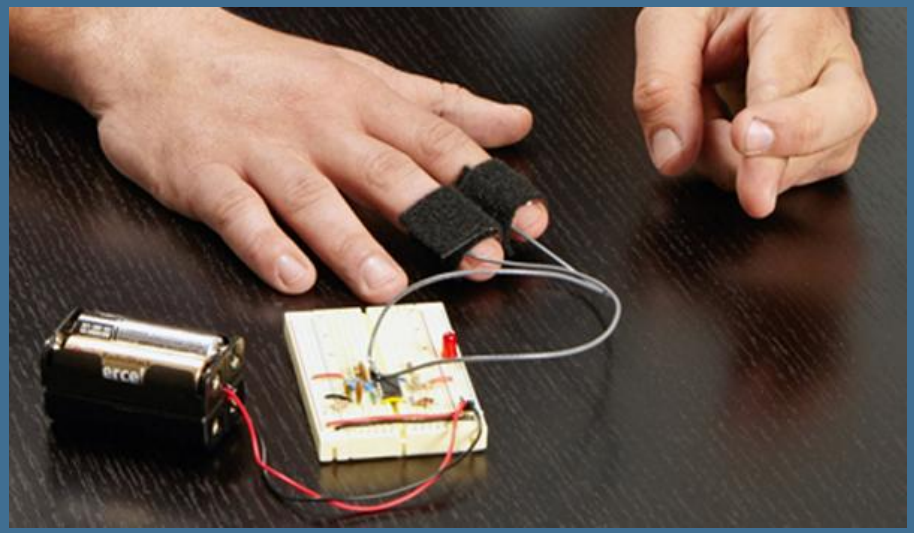
Combined GPS, accelerometer and equipment display

- Modified harvest navigation app from New Zealand that will have accelerometers on the operator, seat and vehicle.

Eye-tracking software

Devices to measure the electrical conductivity of skin

- Measure the changes in skin conductivity that can be an indicator of stress.



Fitbit devices.

Fitbits to measure pulse, and other bio-response variables throughout the day

The process

- We will first test these sensors on our Ponsee simulator, which is currently at OSU, before applying to actual logging operations. Ultimately, we believe that the integration of data from these multiple sensors will allow us to answer the questions in our research project in an innovative method. It will result in data sets that were previously unavailable in logging system studies.

Primary purpose – safety

- The primary purpose of our project is to study the safety of the new systems and compare them to the existing situation. We will collect some economic and environmental impact data as it arises from the stability and human factors work.
  - Production studies – time and motion, shift level and activity sampling will be collected as it is a by-product of the human factors works.
  - Some rut formation and soil disturbance data as it occurs; however, this will be limited to those that are easily collected as a part of the machine stability work.

Future work

- We believe that a full understanding of the environmental impacts on a range of conditions is an important project. We have identified Sustainable Forestry Initiative (SFI) grants as a candidate funding source for this work. This usually occurs in September.

Future Work

- The increased ability to build piles for yarding offer an opportunity to improve logging productivity by piling in locations that have the largest payload. We think the engineering processes under NRI grants may be a suitable funding source for this project. Usually occurs in September and industry partners are useful.

Future Work

- If you are interested please contact me here today or at:

- Kevin.Boston@oregonstate.edu or 541-737-9171.

Questions?