finding somewhere safe to dump the low-level nuclear waste so created (‘Environment’).

**PARABLES AND SCRIPTURE**

*He told them, “The secret of the kingdom of God has been given to you. But to those on the outside everything is said in parables”.*

Mark 4:11

Each chapter of this book starts with a short parable — a short, fictitious narrative, usually containing an unexpected twist in the story line — that aims to provide an insight into a spiritual or moral truth. As with the parables of the New Testament, no explanation or interpretation is offered. Indeed, multiple interpretations are possible. For example, is the parable of the Prodigal Son to do with the young man who wastes his inheritance, the resentment of the older son who obeys the rules and who feels slighted, or the simplicity of the father? You, dear reader, have to figure it out. There is no right or wrong answer. Through his use of parables Jesus was telling us to think.

With regard to the Age of Limits issues described in this book there are rarely any simple answers. As with scripture, we have an obligation to think things through and to avoid quick and easy conclusions.

Each chapter also starts with a quotation from scripture that is pertinent to the topic of that chapter. Additional Biblical quotations are provided throughout the text. In general, the New International Version (NIV) is used. But, on occasion, the King James translation is chosen because its language is so magnificent.

As always when we read scripture, we have to interpret its meaning, both for the people of the times when it was written and for us in our highly industrialized society. For example, the stories of the early chapters of Genesis seem to describe a time when we humans were just establishing our domination of the planet (indeed, some see this part of scripture as being to do with the transition from hunter-gatherer way of life to the more settled agriculture-based economies.)

For example, following the flood, God says to Noah and his sons in Genesis 9,
Be fruitful and increase in number and fill the earth. The fear and dread of you will fall on all the beasts of the earth, and on all the birds in the sky, on every creature that moves along the ground, and on all the fish in the sea; they are given into your hands.

In the context of the times this passage makes sense — humanity has just survived a catastrophe and is starting its world-wide expansion. But in the context of our times following this admonition has brought us an over-populated, polluted, depleted world.

Maybe the following verses from Ecclesiastes 1 are more appropriate to our times.

Generations come and generations go, but the earth remains forever. The sun rises and the sun sets, and hurries back to where it rises. The wind blows to the south and turns to the north; round and round it goes, ever returning on its course. All streams flow into the sea, yet the sea is never full. To the place the streams come from, there they return again.

THE PARABLE OF THE HOME-MADE WINE

The first parable is to do with home-made wine.
Visualize a large jar — a carboy — filled with clear water, grape juice and dissolved sugar. Add yeast to this solution. The yeast, being a living organism, feeds on the dissolved sugar. At first, it’s party time. There is plenty of food and the environment is clean. The yeast population grows and grows.

But all good things come to an end. The supply of sugar is consumed, dead yeast makes the solution cloudy and the liquid now contains fatal quantities of the toxic waste product of the yeast’s feast: alcohol. The yeast population dies both because it runs out of food (sugar), and from the alcohol that it created.

Eventually a layer of dead yeast settles on the bottom of the carboy, the living yeast population dwindles to almost nothing, and the liquid becomes clear. All that is left is a carboy full of clear wine.

**THROUGH A GLASS DARKLY**

This book is about the future. But no one knows what the future holds, at least not in detail. In 1 Corinthians 13 the Apostle Paul says,

> For now we see through a glass, darkly; but then face to face: now I know in part; but then shall I know even as also I am known.

(In this context the word “glass” could refer to either a fogged-up window or to an uneven mirror.)
What Paul is saying is that even he, with all his magnificent intellectual and spiritual gifts, cannot forecast the future. But he does not say that we cannot see through the glass at all — the outlines as to where we are heading are perceptible. So it is with predictions to do with the Age of Limits — the details are hazy, but we can see an outline if we take the time to carry out the necessary research.

The above image shows a fogged-up window. At first all that we see is a blur. But, on closer inspection, we see that there are railings, a river and hills in the distance. We cannot see the details but we can see an outline — and the harder we look the more we see. So it is with our view of the future in an Age of Limits. We cannot predict what will happen in detail, and specific predictions are often wrong. But we have a general sense as where we may be heading. Therefore, although we must be cautious and modest about predicting the future, we still have a responsibility to think about what that future holds, and to have the courage to take action based on our understanding.

When a situation is uncertain, Ugo Bardi offers some advice in his post *How to Predict the Future: Confessions of a Cassandra* (Bardi, How to Predict the Future: Confessions of a Cassandra, 2020), Ugo Bardi develops three “rules” for decent predictions. They are,

1. Always trust thermodynamics;
2. Always mistrust claims of marvelous new technologies; and
3. Always remember that the system has unpredictable tipping points.

His first point is that the laws of thermodynamics are foundational to the physical universe — there is no getting around them. For example, people talk about “saving energy”. But the First Law tells us that energy cannot be saved (or created) — all that we
can do is convert it from one form to another. People also talk about “sustainable” activities. But the Second Law tells us that any action, no matter what it is, leads to an overall increase in entropy. There are no perpetual motion machines. Further discussion to do with the principles of thermodynamics are discussed in Attachment A.

Bardi’s point to do with mistrusting marvelous new technologies relates to the comment to do with thermodynamics. Such technologies often defy the basic laws of physics. They are indeed too good to be true.

With regard to tipping points, we tend to assume that change happens smoothly. We may recognize, for example, that the climate is gradually warming. But we may not understand that the warming could lead to sudden and permanent changes. This idea is expressed in the proverb, “It’s the last straw that breaks the camel’s back”.

An additional difficulty to do with predicting the future is selecting the time frame. When talking about the future we first have to determine what we mean by “the future”? Is it tomorrow, a week from now, five years away or a generation out? The further away it is, the less accurate our predictions will be. We can say with confidence that tomorrow will be much like today, and that the world five years from now will probably not be too different from what it is now. But beyond that the future looks increasingly hazy. After all, who would have predicted as little as ten years ago the impact that social media and mobile phones have already had on the lives of billions of people?

THE NEW CITY OF GOD

The title of this book — A New City of God — is taken from the book City of God, written around the year 420 CE by Augustine of Hippo (354-430 CE). He was living at a time, about 400 years after Christ, when the western Roman Empire was declining; indeed, the City of Rome was sacked during his lifetime in the year 410 CE. Augustine recognized that all human societies collapse sooner or later. For example, the Hebrew Bible is full of “failed states” such as Assyria, Babylon and Ancient Egypt. He said that the only city that is permanent is the City of God. So he and other church fathers of that time set themselves the task of understanding the nature of the City of God — its constitution, so to speak. In doing so they were successfully developing a theology that would provide a structure for the church in the coming centuries: the Dark Ages and the Middle Ages.

There is a similar need for a new theology in our times. Our “City of Man”, our belief in non-stop material progress, seems to be in irreversible decline. The church needs a new faith structure — one that fits a world of climate change, declining resources and over-population.

Augustine wrote two other books that are highly relevant to our times. They are Confessions and De Mendacio (On Lying). The relevance of Augustine’s writings is
described in Chapter 2 (The City of Man), Chapter 3 (Hubris and Nemesis) and Chapter 4 (Truth and Consequences).

Given this background it makes sense to outline the goals of this book. The three principal goals for the book are listed below.

**Goal #1 — Understand What Is Happening**

The first goal is to provide people of faith, many of whom do not have a technical background, with an explanation as to what is taking place. We are facing a plethora of problems in a wide range of areas including with issues such as climate change, resource depletion and population overshoot. These issues are difficult to understand in and of themselves. But they interact with one another in ways that not only difficult to understand, they are often difficult to identify. Each of these issues is difficult to understand in and of itself. And it is even more difficult to identify and understand the manner in which they interact with one another. On top of that we face an incessant stream of fake news, unethical points of view, “truthiness” and misleading factoids. We need to identify the facts, and the manner in which systems interact, as best we can.

Chapters 2 through 5 provide analysis as to the realities of the world that we have entered.

**Goal #2 — A New Theology**

The second goal of the book is to emphasize the need to develop a theology that is appropriate for the new and rather scary world that we are living in. In the past, people of faith developed theologies that addressed their particular social and economic conditions. We need to do the same now. As a starting point, I suggest the following three theological points as a contribution to the discussion.

1. Understand and tell the truth.
2. Accept and adapt.
3. Live within the biosphere.

The meanings of these theological points are developed in later chapters and wrapped up in Chapter 6 — Theology.

**Goal #3 — Determine a Response**

The third goal is to help people of faith to develop a response to the predicaments that we face. The responses can take many forms; they can be organizational/political, or they can be practical, such as planting trees in the neighborhood, or they can be spiritually-focused. These three approaches are not mutually exclusive. For example,
planting a tree is a practical action that can have a spiritual component. It may also be political in that others may be encouraged to do the same thing.

Chapter 7 — The Church’s Response — provides some thoughts as to how people of faith, both as individuals and as part of the larger church, can act in these uncertain and scary times.

ENERGY AND LIFE

All living creatures must take in energy in order to survive, grow and reproduce. Plants take their energy directly from the sun; they use that energy to create complex carbohydrates from water, carbon dioxide and nutrients. Herbivorous animals gain their energy by eating those plants. Carnivorous animals, in turn, acquire their energy from the herbivores that they kill and eat. This model is, to use a currently fashionable word, sustainable. The amount of energy available to the overall system is limited to what is available from sunlight. There may be temporary instances of overshoot in which the population of one particular species expands “non-sustainably” beyond its resource base, but, sooner or later, the size of that population has to align with the amount of energy that is available within the overall system. Humans lived in this type of sustainable environment until about 300 years ago. That was when the fossil fuel party started. We started to exploit a hidden and massive source of energy: fossil fuels buried in the ground. First it was coal; oil and natural gas followed.

For millions of years living organisms (mostly plankton and plants) absorbed energy from the sunlight that fell on earth. They used that energy to grow, flourish and reproduce. When these living organisms died a tiny fraction of them were deposited such that they were subject to intense heat and pressure under ‘anoxic’ conditions, i.e., not in the presence of oxygen. Depending on the temperature and temperature they formed oil, gas or coal. Together these fuels are generally called ‘fossil fuels’ — something of a misnomer since they do not contain fossilized remains. They are made up mostly of carbon and hydrogen, in widely different ratios depending on the nature of the fuel.

This means, therefore, that when we burn coal in a power plant or gasoline in a vehicle, we are actually using stored sunlight, created over many millions of years. This resource, therefore, is non-renewable, at least on a human time scale. When it is gone, it is gone. Like someone who has won the sweepstakes we have been able to spend extravagantly, but, once the money is spent, it is spent.

Throughout this book, the term “fossil fuels” is frequently used. Over unimaginably long periods of time — many millions of years — a small fraction of marine plant and animal life that died settled at the bottom of oceans and lakes under ‘anoxic’ conditions, i.e., zones where very little oxygen was present. If this material was then subject to high temperature and pressure “fossil fuels” in the form of oil were formed. A similar process
took place with regard to the decay of terrestrial plants, except that they tended to form coal and natural gas deposits. On a non-human time scale, the creation and use of fossil fuels is actually a renewable process. The burning of fossil fuels increases the concentration of carbon dioxide (CO$_2$) in the atmosphere. Eventually, over many millions of years, that CO$_2$ will be used by living organisms to grow and reproduce. The remains of some of those organisms will decay and become the source of new fossil fuels. But this process takes place far too slowly for it to benefit us now.

Fossil fuels, particularly crude oil, vary enormously in composition. For example, the crude oil from North Dakota is a light liquid, whereas the crude oil from Venezuela is heavy and viscous. Some fossil fuels, such as coal, have a high carbon content, hence they have a relatively high global warming impact. At the other end of the scale, natural gas consists largely of methane which has a low carbon content (although methane is itself a powerful greenhouse gas).

The Table shows the ‘energy density’ of the two most common fossil fuels: coal and oil. Also shown is the equivalent value for wood. It can be seen that high quality coal (anthracite) provides twice as much energy per unit of weight than wood. The energy density of oil is even greater. Oil is even more attractive as a fuel because, being a liquid, it is easy to transport. Also, when used in boilers and furnaces, it produces much less ash or clinker than oil. Hence machinery can be run for longer without needing maintenance.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Energy (Megajoules / Kilogram)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>16</td>
</tr>
<tr>
<td>Coal (anthracite)</td>
<td>30</td>
</tr>
<tr>
<td>Oil</td>
<td>48</td>
</tr>
</tbody>
</table>

It is these reserves of stored energy that are found in coal, oil and natural gas that we started tapping into around the year 1700, and it is this reserve that has paid for our energy-extravagant lifestyle ever since. It has been the foundation of the 300-year party. Fossil fuels are the cornerstone of the Church of Progress.

Fossil fuels, particularly crude oil, are utterly foundational to modern society. (Oil is particularly crucial because it is used not just as a source of energy but it also provides the chemical building blocks of so many of the manufactured materials that we use.) But fossil fuels are a finite resource — when they are gone, they are gone. And with them goes the basis of our industrial society.

**THE 300-YEAR PARTY**

The fabulous quantities of stored energy that fossil fuels provided formed the basis of the Industrial Revolution and the extraordinary social and economic changes that have taken
place since then. Automobiles, sewers, suburbia, chemotherapy, social media, frequent flier points, vaccinations and computers — to name but a few of those changes — were all made possible by an abundance of fossil fuels. But now the 300-year party is coming to an end. We are depleting our resources and we are filling the environment with our waste products, particularly greenhouse gases in the atmosphere. We have entered an ‘Age of Limits’.

In order to understand how this situation came about it is useful to take a magic carpet ride through northern Europe from east to west in biblical times. The area of interest is circled on the map shown below — an area that Ugo Bardi rather unkindly refers to as, vast regions of fog and swamps, inhabited by hairy Barbarians . . . the area we call today “Western Europe”.

Imagine that airplanes had been invented at that time so that you could fly across northern Europe from what is now western Russia, over the Ukraine, Belorussia, northern Germany and France, and on to England and Eire. Looking down from the airplane you would have seen a continuous forest with a scattering of clearings and villages, and just a few towns — very small by modern standards. These isolated settlements were connected by narrow roads, tracks and footpaths.

Most of that forest has gone now — were you to make the same airplane journey today you would see fields, towns, large cities, railways, airports and roads. Not much of the
primeval forest remains. Why? What happened in the last 2,000 years to cause such a dramatic change in the landscape? Why have the forests disappeared?

One answer is that somewhere around the 7th century the heavy plow was invented. The soils of the Mediterranean are generally light and dry. Therefore, the plows that were used tended to scratch the soil rather than turn it. Because the soil was light, and because the furrow was shallow, the plow was quite easy to pull. Generally, two oxen or horses were more than sufficient. Also, because the team was small and the plow was light it was fairly easy to turn around and plow the next furrow in the reverse direction. Hence the fields tended to be square in shape.

The soils of northern Europe, on the other hand, are generally heavy, and the climate is wet. This made it difficult to use Mediterranean-style plows. But the invention of the heavy plow overcame this problem. It had a vertical knife with an iron cutting edge, a horizontal share to slice under the sod, and a moldboard to turn it over. The effort required meant that a larger team of up to eight oxen was needed. Turning the team was difficult and required more space than the Mediterranean system, so the fields tended to consist of long, narrow strips. The effectiveness of the new plow meant that huge areas of land could be opened up for cultivation.

Because few peasants could afford eight oxen or their own plow, they had to pool their equipment to form communal teams. Consequently, society gradually came to be organized around the demands of this new technology. Indeed, the heavy iron plow can be seen as being one of the precursors to the industrial revolution, both technologically and organizationally. But first the trees had to be cut down, which they were.

The availability of the new agricultural land and the consequent increase in the supply of food allowed for population growth and for changes in the way society was organized.
The surplus food meant that more people could move to the towns and work in activities that did not directly contribute toward the production of that food. Society could also now afford luxuries such as standing armies, monumental architecture, priests and libraries.

A positive feedback cycle ensued, one that is eerily similar to what we are experiencing now (except that, in our case, it is oil that is disappearing, not trees). As the forests were cleared, more crops were produced, so the population grew, so more land was needed to feed the increased number of people, so more forests were cleared, and so on and so on. Eventually, of course, a limit was reached; by the late 17th century much of the forest had been chopped down so there was not much new arable land to exploit. The picture below shows the North York Moors in northern England — an area now regarded as a place of natural beauty. In point of fact, the original, natural beauty of this area is forest, not moorland.

A (partly natural) beautiful scene

As agriculture developed, society was not just running out of newly available land, but it was also using up its supply of wood that had been provided by the forests. Wood was an absolutely crucial resource for mediaeval civilization — not just as a source of heat, but also as the universal material of construction for everything: buildings, tools, boats and all types of equipment, including the cross plow itself.

This was also a time when industrialization was developing; the new industries needed wood as a source of fuel. So, deforestation created a double-edged dilemma: there was less new arable land to feed a burgeoning population, and the supply of wood — the raw material needed for equipment, buildings, heat and industry — was being depleted. Consequently, the people of the of northern Europe in the late Middle Ages were faced with a conundrum: where were they to find a new source of energy? Their answer, just like ours now, was to find a source of “alternative energy” — which, in their case, meant coal, followed by oil and natural gas.